Fundamental and Technical Analysis:

Substitutes or Complements?

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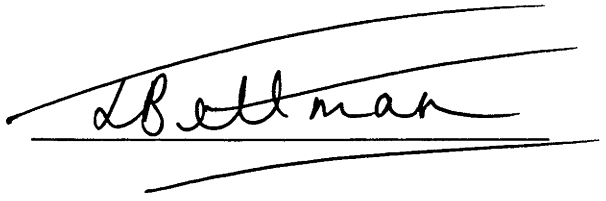
Declaration

I hereby certify that this thesis is entirely the work of the author and has not been submitted to any other institution or University. Furthermore, all sources used in the preparation of the thesis have been acknowledged in the usual manner.



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Abstract

While the fundamental and technical analysis literatures invest considerable effort in assessing their respective ability to explain share prices, they invariably do so without reference to each other. In this context, we propose an equity valuation model integrating both fundamental and technical analysis and, in doing so, recognise their potential as complements rather than as substitutes in such valuation exercises. Specifically, we augment fundamental valuation models with a suite of technical measures to investigate whether these resultant hybrid models have superior explanatory power relative to models incorporating either measures of fundamental or technical information in isolation.

Our analysis commences with a consideration of the strength of our hybrid models in explaining the share price of listed Australian companies relative to purely fundamental or technical models. Thereafter, we extend our investigation to assess the complementary nature of fundamental and technical analysis in the valuation of listed companies from the United States ("US"), as well as listed companies in seven other countries.

Preliminary testing confirms the positive dependence of contemporaneous price on the fundamental factors commonly employed in modelling, namely book value per share, and earnings per share. Furthermore, the inclusion of forecast earnings per share in the fundamental valuation model subsumes the earnings per share variable in seven of the nine countries studied.

Supplementation of fundamental models with our three technical measures sees all technical factors being significant in explaining contemporaneous share prices in the majority of the countries examined in the dissertation. Overall, testing confirms the complementary nature of fundamental and technical analysis by showing that, while each performs well in isolation, models integrating both have superior explanatory power.

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Chapter One: Introduction

Identifying the factors important in explaining contemporaneous equity prices has long been a focus of the valuation literature, with research divisible into the two rich but largely distinct and often competing arms of fundamental (see, for example, Holthausen and Watts, 2001) and technical analysis (see, for example, Lo and MacKinlay, 1988 and 1999). While proponents of each type of analysis have invariably agreed upon the general nature of factors important in explaining share prices, identifying specific value relevant variables is a point of ongoing debate.

Despite voluminous evidence regarding the strength of fundamental and technical factors in explaining equity prices, valuation models simultaneously incorporating both types of measure are all but non-existent. In this context, we propose valuation models that integrate aspects of both fundamental and technical analysis and, in doing so, recognise their potential as complements rather than substitutes. More specifically, we utilise an unconstrained version of Ohlson's (1995) valuation model, a model which investigates the value relevance of the book value of equity, contemporaneous earnings and consensus earnings forecasts. We augment this model with a suite of three technical factors, namely lagged price and two momentum dummy variables to capture extreme past performance.

Specifically, these technical factors account for past price levels and changes in these levels and, therefore, form a suite of technical measures. Our decision to examine the importance of these factors in explaining contemporaneous price is made with reference to other arms of the empirical literature. With respect to the former, some research argues that the best predictor of current price is past price, or that the share market exhibits weak form efficiency (see, for example, Fama, 1970).

If this is indeed the case, the best explanator of contemporaneous price is past price, a fact leading to its inclusion in modelling undertaken in the current study.

However, more recent work, including the seminal paper of Jegadeesh and Titman (1993), challenges market efficiency, showing predictability of returns or momentum in the case of stocks exhibiting extreme performance. Specifically, numerous studies have documented the profitability of buying an equally weighted portfolio of stocks performing in the top decile over the prior three to twelve months, simultaneously short-selling an equally weighted portfolio of stocks performing in the lowest decile over the same period and holding the resultant position for a further three to twelve months (see, for example, Jegadeesh and Titman, 1993).

Whilst the profitability of such so-called momentum trading strategies represent a deviation from the market efficiency, the existence of these opportunities are well documented both through time (see, for example, Jegadeesh and Titman, 2001) and in the context of different equity markets (see, for example, Liu *et al*, 1999; Rouwenhorst, 1998 and 1999; and, Griffin *et al*, 2003). The momentum literature, together with the work of researchers such as Cahart (1997) and Grundy and Martin (2001), would suggest that past performance persistence is important in explaining the cross-sectional variation in contemporaneous share prices and, in light of this, we include it in modelling.

Empirically, to allow for the possibility that fundamental and technical analyses act as substitutes rather than as complements, we commence our analysis by modelling equity prices solely as a function of fundamental factors and, thereafter, consider

the ability of technical factors in isolation to explain price. Next, we fit our hybrid models and, lastly consider the performance of our models relative to those modelling price solely as a function of either fundamental or technical factors.

Our analysis begins with an examination of Australian listed companies, followed by considering a dataset comprising companies from the US. Furthermore, to provide international evidence, we investigate a comparative international study, comprising Australian and US listed companies, and an additional seven, namely: Canada; France; Germany; Hong Kong; Japan; Singapore; and the United Kingdom ("UK"). The analysis for all countries is performed over the period January 1990 to December 2004, inclusive.

Results of fitting fundamental models confirm that contemporaneous share price is positively dependent on book value per share and earnings per share. Furthermore, consistent with Dechow *et al* (1999) the inclusion of forecast earnings per share in model fitting generally subsumes the information content in contemporaneous earnings per share. Empirical findings pertaining to the technical model generally confirm the importance of technical factors in equity valuation exercises. Specifically, contemporaneous price is highly dependent on lagged price, and companies exhibiting returns in the six month formation period that place them in the top (bottom) performance decile continue to enjoy similar positive (negative) performance in the subsequent six months.

Moreover, the results of testing our hybrid models not only confirm the importance of both fundamental and technical analyses in explaining price, but also reveal the superior explanatory power of these models relative to those considering either

fundamental or technical variables in isolation. This strength of our hybrid models is best evidenced by their markedly higher (lower) adjusted R^2 values (Akaike Information Criterion, "AIC", values) relative to models solely incorporating either fundamental or technical measures, together with the highly significant results of our likelihood ratio tests. Overall, we conclude there is strong evidence regarding the complementary nature of fundamental and technical factors in equity valuation exercises.

The remainder of this dissertation is structured as follows: Chapter Two provides a review of the extant literature pertaining to fundamental and technical analysis; Chapter Three outlines the methodology employed in assessing the ability of fundamental and technical analysis to explain share prices both in isolation and in combination; Chapter Four describes the characteristics of the three datasets, also discussing the process employed in collecting them; Chapter Five presents and discusses key results of testing in Australia; Chapter Six details the findings pertaining to the US dataset; Chapter Seven provides the results of the international comparative study; and, Chapter Eight concludes.

Chapter Two: Literature Review

2.1 Introduction

The valuation literature has invested considerable effort in identifying value relevant variables. More specifically, extant research highlights the importance of two broad types of variables, namely, fundamental and technical factors. However, examination of this research reveals two interesting features: While proponents of each type of analysis invariably agree upon the general nature of factors important in explaining share prices, there lacks a general consensus on specific value relevant factors; and, the research focuses on each factor in isolation, rather than in combination.

With these characteristics in mind, Chapter Two commences by reviewing evidence on the importance of fundamental factors in equity valuation exercises (Section 2.2). Thereafter, the chapter overviews research into the power of technical factors in explaining contemporaneous share prices (Section 2.3).

2.2 Fundamental Analysis

Graham and Dodd (1934) are among the first to formally argue the importance of fundamental factors in share valuation exercises. Subsequent studies further detail the relationship between share price and fundamental factors, with Gordon and Shapiro's (1956) Dividend Discount Model not only becoming one of the most widely cited models in modern finance theory, but also providing the foundation for voluminous subsequent research.

In the context of this dissertation, the most notable extension of Gordon and Shapiro's (1956) work is provided by Ohlson (1995), who formulates a model expressing price as a linear function of book value per share, earnings per share and a vector of other value-relevant information. Subsequent research invests considerable effort in empirically testing numerous variations of Ohlson's (1995) Residual Income Valuation Model, with early studies invariably lending support to the (positive) dependence of equity values on both book value per share and earnings per share (see, for example, Collins *et al*, 1997; and Ely and Waymire, 1999). These findings are consistent with the liquidation or adaptation value of the firm's assets (Berger *et al*, 1996) and their value in use (Barth *et al*, 1996), respectively.

More recently, researchers have turned their focus to identifying variables forming part of Ohlson's (1995) vector of other value relevant information, with one stream of the literature supplementing the aforementioned two-factor model to include forecast earnings per share (see, for example, Dechow *et al*, 1999; and Morel, 2003). Results of this testing reveals that, while forecast earnings is significant and positive in explaining price, its inclusion sees contemporaneous earnings ceasing to be value relevant. Dechow *et al* (1999, p 26) suggest this result is not unexpected as "analysts' forecasts of next year's earnings subsume value relevant information in current earnings".

In addition to exploring the importance of book values and current and forecast earnings in explaining price, the literature also considers the value relevance of a suite of other accounting variables (see, for example, Amir and Lev, 1996; and, Amir *et al*, 1997, among others), with a comprehensive summary of these findings

provided by Holthausen and Watts (2001). While recent empirical research is yet to reach a consensus regarding the identity of these "other" value relevant variables, there seems little disagreement regarding the appropriateness of Ohlson's (1995) model as a foundation for these fundamental valuation exercises.

2.3 Technical Analysis

The ability of a variety of technical factors to explain share prices has long fascinated practitioners and academics. Indeed, recognition of the potential for past prices, and movements therein, to predict future equity values dates back to a series of editorials published by Charles Dow in the Wall Street Journal between 1900 and 1902. The publication of these editorials prompted further research into the ability of technical analysis to explain current and future share prices as well as equity returns. One arm of this literature dismisses the random walk hypothesis, agreeing upon the ability of past prices to forecast future returns (see, for example, Lo and MacKinlay, 1988 and 1999).

Another arm of technical research tests the ability of various trading rules to generate superior profits, with these studies providing support for the role of technical analysis in predicting future share performance (see, for example, Brock *et al*, 1992; and, Allen and Karjalianen, 1999). However, the reliability of these results are called into question by research as early as that of Jensen and Bennington (1970), who argue their potential to be explained by data-snooping biases.

Despite such criticisms, a technique that comprehensively accounts for data-snooping biases is not employed in testing prior to the work of Sullivan *et al* (1999), who apply White's Reality Check bootstrap methodology to Brock *et al*'s (1992)

trading rules and dataset. Interestingly, the application of this technique on the same dataset as Brock *et al*'s (1992) sees findings remain unchanged. However, when re-performing testing with a more recent dataset, Sullivan *et al* (1999) report that all profits associated with Brock *et al*'s (1992) trading rules disappear. Sullivan *et al* (1999, p. 1684) argue that, whilst data-snooping biases may not explain the historical profitability of trading based on technical analysis, such trading strategies are no longer profitable given the increased efficiency of equity markets afforded by "cheaper computing power, the lower transaction costs and increased liquidity". This argument is supported by Ready (2002), who documents the inability of either Brock *et al*'s (1992) or Allen and Karjalianen's (1999) trading rules to consistently outperform a buy and hold strategy in recent times.

Yet another subset of the technical literature considers the profitability of momentum strategies, which involve taking positions in portfolios constructed on the basis of historical performance, and holding them for a pre-defined period. While momentum research supports the profitability of buying a portfolio of past "winners" and simultaneously short selling a portfolio of past "losers", then holding the resultant position for three to twelve months (see, for example, Jegadeesh and Titman, 1993 and 2001), it has met with considerable scepticism given the challenge it poses for the Efficient Market Hypothesis.

However, proponents of momentum provide evidence dismissive of these concerns, which include data snooping and questions regarding the economic significance of results. More specifically, this research reports that momentum profits are robust to the introduction of transaction costs (see, for example, Korajczyk and Sadka, 2004) as well as through time (see, for example, Grundy and Martin, 2001; and, Jegadeesh

and Titman, 2001) and across multiple equity markets (Rouwenhorst, 1998; Liu *et al*, 1999; and, Griffin *et al*, 2003).

Further, evidence regarding the profitability of momentum trading strategies is not confined to US equity markets, with profits also observed in the UK (see, for example, Liu *et al*, 1999), Europe (see, for example, Rouwenhorst, 1998; Nijman *et al*, 2002; and, Forner and Marhuenda, 2003), and in a number of developing markets (see, for example, Rouwenhorst, 1999; and, Griffin *et al*, 2003). However, testing does not reach a consensus regarding the profitability of momentum trading strategies in the context of Asian markets. Specifically, Hameed and Kusnadi (2002) fail to find evidence of momentum profits in Hong Kong, Malaysia, Singapore, South Korea, Taiwan, or Thailand. Similarly, Griffin *et al* (2003) document the absence of significant momentum profits in fourteen Asian markets[1]. Further, Chui *et al* (2000) report insignificant momentum profits in the eight Asian markets they study.[2] In contrast to these findings, Hurn and Pavlov (2003), Demir *et al* (2004), and, Marshall and Cahan (2005) all report the existence of significant momentum profits in the Australian equity market.

Taking the preceding discussion as a whole, two types of technical analysis are consistently documented as important in predicting prices and returns: Lagged price; and, momentum. Indeed, their importance has already been recognised outside the technical analysis literature. By way of example, the ability of momentum to explain the cross-sectional variation in returns has already been recognised by Carhart (1997), who reports its significance in explaining mutual

[1] Griffin *et al* (2003) study 14 Asian countries: Australia; China; Hong Kong; India; Indonesia; Japan; Malaysia; New Zealand; Pakistan; Philippines; Singapore; South Korea; Taiwan; and, Thailand.

[2] Chui *et al* (2000) include eight Asian markets: Hong Kong, Indonesia, Japan, Korea, Malaysia, Singapore, Taiwan, and Thailand.

fund performance persistence when supplementing Fama and French's (1993) three factors to form a four-factor asset pricing model. Further, the complementary nature of technical and fundamental analysis is identified by Taylor and Allen (1992), who note that some 90% of foreign exchange market dealers rely upon both technical and fundamental analysis.

2.4 Conclusion

Notwithstanding the preceding discussion of the literature which highlights the importance of fundamental and technical analyses in explaining contemporaneous share prices, models incorporating both classes of factors are all but non-existent. As such, there is little evidence regarding whether these two sets of factors are complementary.

To facilitate comparison with the extant literature, we commence our analysis by modelling price as a function of either fundamental or technical factors in isolation. Thereafter, we assess the complementary nature of fundamental and technical analysis by augmenting an unconstrained version of Ohlson's (1995) valuation model with three technical factors, namely, lagged price and two momentum dummy variables. Having fit these models, we then assess their strength in explaining contemporaneous share prices relative to those employing either fundamental or technical factors in isolation. The methodology we employ in providing this evidence is overviewed in Chapter Three.

Chapter Three: Methodology

3.1 Introduction

Chapter Three details the methodological approach we employ to examine whether fundamental and technical information act as substitutes or complements in equity valuation exercises. We apply the methodology detailed in this chapter to three datasets, specifically: One comprising listed Australian companies (Chapter Five); One comprising US listed companies (Chapter Six); and, finally, An international dataset comprising listed companies in Australia, the US and seven other countries, namely, Canada, France, Germany, Hong Kong, Japan, Singapore, and the UK (Chapter Seven). Our international analysis sees us fit models using data from each of the nine countries in isolation as well as using a pooled dataset incorporating observations from all countries. Further detail regarding these datasets, including their construction, is provided in Chapter Four.

To ensure comparability with the extant literature and to assess the importance of fundamental factors in explaining share prices in each of our datasets, we commence with a discussion of the fundamental models we fit (Section 3.2). Thereafter, we overview the model comprising solely technical factors which we fit to test the importance of this class of information in equity valuation exercises (Section 3.3). Next, we present the hybrid models which evaluate whether fundamental and technical factors act as complements or substitutes in explaining share prices (Section 3.4). Following this, we discuss the tests we utilise to assess the relative explanatory power of fundamental, technical and hybrid models (Section 3.5). Finally, we detail the robustness testing utilised in investigating whether the US dominates the pooled sample (Section 3.6).

3.2 The Fundamental Models

We employ two models to examine the ability of fundamental factors to explain equity prices. First, we fit a two-factor fundamental model similar to that of Collins *et al* (1997), relating price to the book value per share and current earnings per share. This model is formally presented as follows:[3]

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \qquad (1)$$

Where:

P_{t+1}	=	the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced;
$BVPS_t$	=	the book value of the firm's equity calculated as at the end of the most recent fiscal year relative to month t; and,
EPS_t	=	the diluted earnings per share of the firm calculated at the end of the most recent fiscal year relative to month t and announced to the market in month t.

Previous testing of models similar to (1) reveals that price is highly positively dependent on book value per share (see, for example, Collins *et al*, 1997; Dechow *et al*, 1999; and, Ely and Waymire, 1999). Two reasons have been advanced for this dependence, namely that book value represents the resources a firm has which can be devoted to generate future earnings and also measuring the liquidation or adaptation value of the firm's assets (Berger, *et al*, 1996; and, Burgstahler and Dichev, 1997, respectively).

[3] To ensure our results are unbiased, we estimate regression coefficients in all testing using heteroscedasticity and autocorrelation (HAC) consistent standard errors. Specifically, HAC standard errors are calculated using the Newey-West (1987) adjustment.

As with book value per share, research documents current earnings per share as a positive explanator of share price (see, for example, Easton, 1985; Collins *et al*, 1997; Dechow *et al*, 1999; and, Ely and Waymire, 1999). The main explanation offered for this finding is that contemporaneous earnings per share serves as a proxy for the current value of the firm, while book value per share represents the firm's exit value (see, for example, Barth *et al*, 1996).

More recent research supplements a model similar to (1) with forecast earnings per share (see, for example, Dechow *et al*, 1999), arguing that it represents a proxy for the other value-relevant information variable included in Ohlson's (1995) model. We test an unconstrained version of the resultant model, which is expressed as follows:

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \qquad (2)$$

Where:

P_{t+1}	=	the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced;
$BVPS_t$	=	the book value of the firm's equity calculated as at the end of the most recent fiscal year relative to month t;
EPS_t	=	the diluted earnings per share of the firm calculated at the end of the most recent fiscal year relative to month t and announced to the market in month t; and,
$FEPS_{t+1}$	=	the consensus forecast earnings per share for the firm, as forecast in the middle of the month following the release of actual earnings per share figures for the most recent fiscal year.

Research fitting models similar to (2) to US datasets yields an interesting result: Whilst price exhibits the expected positive statistical dependence on both book value per share and the consensus forecast earnings per share, current earnings per share ceases to be a significant explanator given the presence of the aforementioned independent variables. Dechow *et al* (1999) argue that such a result is consistent with the consensus forecast earnings measure not only subsuming the information contained in the current earnings figure, but also offering incremental information about the future prospects of the company. Results of fitting Models (1) and (2) using Australian, US and international datasets are reported in Chapters Five, Six and Seven, respectively.

3.3 The Technical Model

In providing evidence on the power of technical factors to explain contemporaneous equity values, we model price as a function of past price and our momentum measures. Our model is formally presented as follows:

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \qquad (3)$$

Where:

P_{t+1} = the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced;

P_{t-5} = the firm's end-of-month share price six months prior to that denoted by P_{t+1};

D_{Up} = a dummy variable equal to 1 if the stock holding period return in the six month period commencing one year prior to the measurement of P_{t+1} placed it in the highest performance decile, else 0; and,

D_{Down} = a dummy variable equal to 1 if the stock holding period return in the six month period commencing one year prior to the measurement of P_{t+1} placed it in the lowest performance decile, else 0.

Model (3) incorporates lagged price as an explanator given that the technical literature agrees on its ability to forecast future returns (see, for example, Lo and MacKinlay, 1988 and 1999).[4] Similarly, momentum factors are included in light of strong evidence suggesting performance persistence in equity markets (see, for example, Jegadeesh and Titman, 1993) and the robustness of these findings to critiques of data-snooping biases (see, for example, Jegadeesh and Titman, 2001; and, Grundy and Martin, 2001) and economic insignificance (see, for example, Korajczyk and Sadka, 2004).

The momentum factors incorporated in Model (3) are dummy variables capturing extreme past return performance and are assigned based on the momentum measure advanced by Jegadeesh and Titman (1993 and 2001). In constructing these variables, we first calculate the buy and hold return on shares accruing over the six month period commencing exactly one year from the time we model price, an approach analogous to calculating Jegadeesh and Titman's (1993 and 2001) formation period return. Based on these returns, we rank shares and assign them to performance deciles.

Shares included in the top (bottom) decile are allocated a D_{Up} (D_{Down}) dummy equal to one in order to reflect their extreme positive (negative) performance over the

[4] A considerable body of literature provides evidence on the spuriousness of results obtained when regressing contemporaneous dependent variables on their lagged values in the context of time series studies (see, for example, Yule, 1926; and, Granger and Hyung, 2001). However, a subsection of this literature confirms this issue does not extend to research utilising cross-sectional data sets (see, for example, Ferson *et al* 2003a and 2003b), and hence, is not a concern in this dissertation.

period. Conversely, all shares in the remaining deciles are assigned momentum dummies equal to zero. If performance does indeed persist over the ensuing six months, a timeframe equivalent to Jegadeesh and Titman's (1993 and 2001) performance period, we expect to see D_{Up} (D_{Down}) as a significantly positive (negative) explanator of price when fitting Model (3). The findings pertaining to the technical model are detailed in Section 5.3 (Australia), Section 6.3 (the US), and Section 7.3 (the international comparative study).

3.4 The Hybrid Models

After fitting models of price as a function of either fundamental or technical factors, we incorporate both sets of measures to generate our hybrid models. More specifically, we supplement Models (1) and (2) with the suite of technical factors included in (3), yielding Models (4) and (5), below:

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Where:

P_{t+1} = the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced;

$BVPS_t$ = the book value of the firm's equity calculated as at the end of the most recent fiscal year relative to month t;

EPS_t = the diluted earnings per share of the firm calculated at the end of the most recent fiscal year relative to month t and announced to the market in month t;

$FEPS_{t+1}$ = the consensus forecast earnings per share for the firm, as forecast in the middle of the month following the release of actual earnings per share figures for the most recent fiscal year.

P_{t-5} = the firm's end-of-month share price six months prior to that denoted by P_{t+1};

D_{Up} = a dummy variable equal to 1 if the stock holding period return in the six month period commencing one year prior to the measurement of P_{t+1} placed it in the highest performance decile, else 0; and,

D_{Down} = a dummy variable equal to 1 if the stock holding period return in the six month period commencing one year prior to the measurement of P_{t+1} placed it in the lowest performance decile, else 0.

Results of fitting Models (4) and (5) using Australian, US and international datasets are reported in Chapters Five, Six and Seven, respectively.

3.5 Evaluating the Relative Strength of the Models

In order to provide a meaningful comparison of the explanatory power of Models (1) to (5) and, in doing so, draw inferences regarding the model best able to explain contemporaneous share prices, we use three goodness of fit criterion, namely the adjusted R^2, AIC, and likelihood ratio tests. While a comparison of adjusted R^2 values is meaningful given all models have the same dependent variable, namely, contemporaneous price, AIC estimates are also utilised given their consideration of entropy and ability to report the goodness of fit for a particular model by trading off the complexity of a model against how well it fits the data (see, for example, Akaike, 1974).

Further, the use of likelihood ratio tests are ideal in this dissertation due to their ability to compare two competing models where one is the nested version of the other (see, for example, Felsenstein, 1981; Huelsenbeck and Crandall, 1997; and, Huelsenbeck and Rannala, 1997). As such, these three measures provide the

necessary information to determine whether technical and fundamental information act as substitutes or complements, with results using Australian, US and international datasets reported in Chapters Five, Six and Seven, respectively.

3.6 Does the United States Dominate the Pooled Sample?

We merge the observations from the nine countries studied in this thesis to obtain a pooled sample. Over 65% of the resultant pooled sample observations relate to US listed companies.[5] A concern arising from this is that the US may dominate the aggregate results. As such, to control for the US, we include slope and interactive dummy variables in Models (1) through (5).[6] Specifically, D_{NonUS} equals one for any observation pertaining to non-US listed companies, or zero otherwise. In evaluating these results, when D_{NonUS} equals zero, we will obtain coefficient values that match those observed in our US findings. Results of this testing is reported in Section 7.6.

[5] Sample sizes relating to individual countries are contained in the descriptive statistics for each individual country in Appendix A.

[6] For brevity, we do not restate the Models. However, they are formally presented for the fundamental models in Tables 7.7 and the models containing technical factors in Table 7.8.

Chapter Four: Data

4.1 Introduction

Chapter Four commences with an overview of the process employed to collect the three datasets used to evaluate the complementary nature of fundamental and technical information in equity markets (Section 4.2). Specifically, we first consider a dataset comprising listed Australian companies, followed by a sample that solely consists of US listed companies. Finally, the international dataset comprises listed companies in Australia, the US and seven other countries, namely: Canada; France; Germany; Hong Kong; Japan; Singapore; and, the UK.

Furthermore, in testing the international dataset, we consider each of the nine countries in isolation as well as using a pooled dataset incorporating observations from all countries. The datasets include all listed companies over the sample period January 1990 through December 2004. Thereafter, the chapter provides a discussion of the filters applied to the initial datasets (Section 4.3), together with descriptive statistics for the final datasets utilised in testing (Section 4.4).

4.2 Dataset Construction

Initially, the three datasets employed in testing comprise the universe of companies for which all necessary data is available. Details of the data, together with their respective sources, are provided in Table 4.1, with a timeline for variable construction provide in Figure 4.1.

Table 4.1: Variable Definition and Measurement

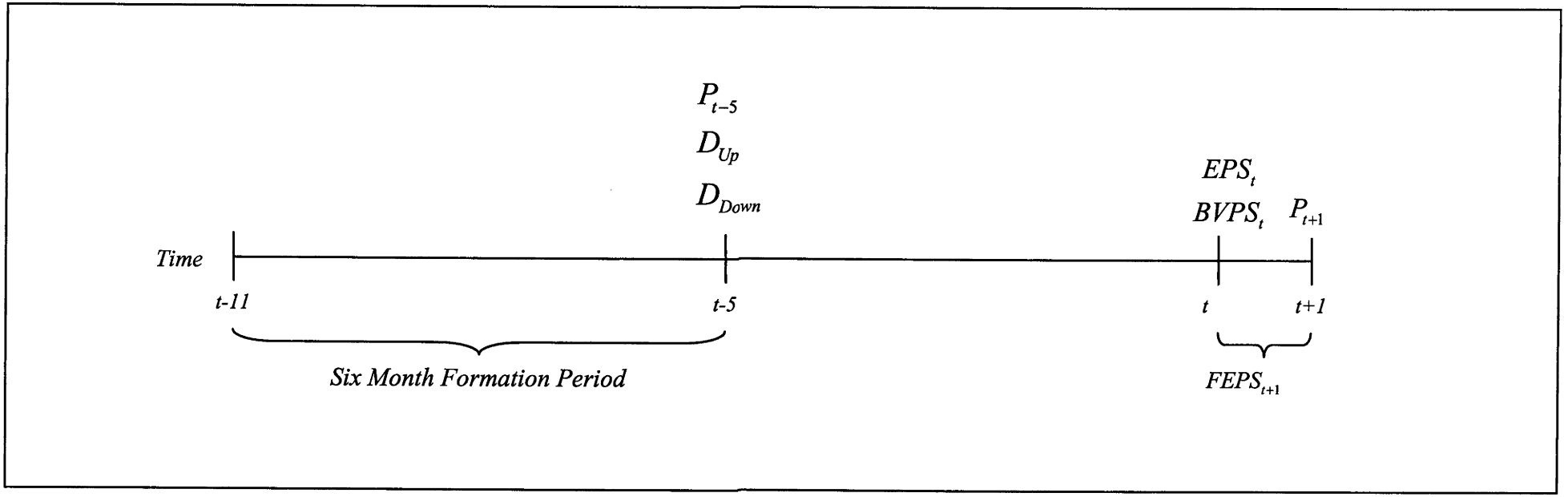
Table 4.1 includes the definitions of all variables employed in Models (1) to (5). More specifically, the table details the manner in which variables are calculated, as well as providing information on the source of variable constituents.

Variable	*Definition*	*United States*	*Other Countries*
P_{t+1}	The firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes.	CRSP	DataStream International
P_{t-5}	The firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes.	CRSP	DataStream International
$BVPS_t$	The book value per share of the firm calculated as at the end of the most recent fiscal year relative to month t.	COMPUSTAT Industrial Annual[7]	DataStream International
EPS_t	The earnings per share of the firm calculated at the end of the most recent fiscal year relative to month t and announced to the market in month t.	COMPUSTAT Industrial Annual[8]	DataStream International
$FEPS_{t+1}$	The consensus forecast earnings per share for the firm, as forecast in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.	I/B/E/S	I/B/E/S
D_{Up}	A dummy variable equal to 1 if the stock holding period return in the six month period commencing one year prior to the measurement of P_{t+1} placed it in the highest performance decile, else 0.	CRSP	DataStream International
D_{Down}	A dummy variable equal to 1 if the stock holding period return in the six month period commencing one year prior to the measurement of P_{t+1} placed it in the lowest performance decile, else 0.	CRSP	DataStream International

[7] The book value of the firm's equity (data60) scaled by shares outstanding (data25) and subsequently adjusted for capitalisation changes (data27).
[8] The diluted earnings per share of the firm (data57) adjusted for capitalisation changes (data27).

Figure 4.1: Timeline of Variable Construction

Figure 4.1 graphically represents the points in time at which the variables for the datasets are measured. Notation employed in this table is as follows: P_{t-5}, is the firm's end-of-month share price six months prior to that denoted by P_{t+1}, adjusted for capitalisation changes; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; $FEPS_{t+1}$ is consensus analyst forecast earning per share as reported in the month following the release of actual earnings per share figures for the most recent fiscal year, adjusted for capitalisation changes and are generally announced in the middle of the month, though the exact date varies slightly; and, P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced adjusted for capitalisation changes.



Examination of Table 4.1 reveals that, for some countries, data sources vary. More specifically, share price and returns data for the US is obtained from the Center for Research and Security Prices ("CRSP") files, with share prices and returns for the other countries collected from DataStream International. In addition, accounting variables for the US are sourced from Compustat Industrial Annual files, with information for the other countries obtained from DataStream International. Further, for all countries in the sample, we acquire consensus earnings per share forecasts from I/B/E/S.

Initially, as depicted graphically in Figure 4.1, we utilise return information for the entire universe of companies in each country to calculate the momentum dummies in the manner described in Section 3.3. In addition, we obtain the date in which the accounting information is released to the market from I/B/E/S. Specifically, we ascertain both book value per share and (diluted) current earnings per share measures relating to the most recently ended fiscal year, and merge these values together using unique company identifiers.

Thereafter, we collect consensus analysts' earnings per share forecasts in the month following the release of the accounting information.[9] To ensure the comparability of the forecast figures obtained from I/B/E/S with the reported (diluted) earnings figures obtained from Compustat and DataStream International, before proceeding further, we convert all forecast figures reported on a primary basis into diluted equivalents. In undertaking this exercise, we exclude any observation for which the basis of reporting forecast earnings figures cannot be ascertained.

[9] This ensures that the analysts' forecasts incorporate the released accounting information.

Finally, with respect to the dependent price variable incorporated in modelling, as forecast earnings figures are invariably released in the middle of any given month, to ensure the market has had opportunity to impound this information, we take prices at the end of the same month. This matching approach is similar to that employed by previous research including that of Dechow *et al* (1999). We also obtain the end of month price six months prior to the aforementioned share price for modelling technical information. Lastly, after merging these end of month share prices based on the unique company identifier, we remove any incomplete observation from the resultant dataset.[10]

4.3 Filtering Procedure

After merging the aforementioned datasets, we apply several filters to the resultant sample. Specifically, consistent with prior work including that of Collins *et al* (1997) and Morel (2003), we remove from the sample any companies with book values per share equal to or less than zero.[11] Further, consistent with each individual country's reporting requirements, we exclude firms who do not disclose their annual financial information to the market within the required time of the fiscal year end.[12] Finally, we perform diagnostic tests to identify any influential data points. These points are removed from the dataset, yielding a final pooled cross-sectional sample of 51,689 firm-year observations. A breakdown of observations for each country is provided in the descriptive statistics tables in Appendix A.

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[10] The removal of incomplete observations results in the exclusion of firms that are not followed by analysts. An obvious extension to this study would be to re-perform testing on a dataset including these firms. However, for consistency across testing, we only consider observations that contain all necessary variables.

[11] Collins *et al* (1997) and Morel (2003) remove such observations, given they are not economically rational.

[12] This results in only 46 observations being removed from the sample. Re-performing testing including these observations reveals that their exclusion has no significant impact on the results reported.

4.4 Descriptive Statistics

Descriptive statistics and correlation coefficients calculated for the pooled international dataset are presented in Tables 4.2 and 4.3, respectively. The statistics calculated in respect of each individual country are presented in Appendices A and B, respectively.[13]

From Table 4.2 it is evident that the sample companies are representative of the market as a whole, being drawn from the entire size gamut. Further, Table 4.3 (and Appendix B for individual country correlation matrices) reveals nothing of great concern with respect to multicollinearity. While the correlation between P_{t+1} and P_{t-5} is 0.84, this value is unsurprising given that these variables represent the price of a company six months apart. To allay any non-stationarity concerns in relation to price, we perform an Augmented Dickey-Fuller test, which confirms that price is indeed stationary.

[13] The international comparative study necessitates the reporting of all variables for each country to be expressed in one common currency. As such, we collect DataStream International exchange rates to convert all variables into US dollars.

Table 4.2: Pooled Sample Descriptive Statistics

Table 4.2 presents the descriptive statistics in US dollars for the aggregated international sample utilised in testing (n = 51,689). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	49.67	192.99	0.01	7182.90	5.17	11.88	23.64
P_{t-5}	46.88	193.26	0.01	7213.80	4.94	11.34	22.59
$BVPS_t$	22.32	81.99	0.01	1812.81	2.61	5.75	11.60
EPS_t	2.10	15.16	-406.67	494.85	0.07	0.48	1.24
$FEPS_{t+1}$	3.06	12.14	-183.72	398.56	0.21	0.71	1.54

Table 4.3: Pooled Sample Correlation Matrix

Table 4.3 presents the correlation matrices in US dollars for the sample utilised in testing (n = 51,689). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+2}$
P_{t+1}	1.00				
P_{t-5}	0.84	1.00			
$BVPS_t$	0.68	0.62	1.00		
EPS_t	0.54	0.50	0.49	1.00	
$FEPS_{t+1}$	0.72	0.71	0.69	0.37	1.00

Chapter Five: Australian Results

5.1 Introduction

Chapter Five presents the results of fitting the fundamental, technical and hybrid models to our Australian dataset, and commences with a discussion of the significance of variables included in the fundamental models (Section 5.2). Thereafter, the chapter reports findings relating to the importance of technical factors in explaining contemporaneous equity prices of listed Australian companies (Section 5.3). Next, preliminary evidence regarding the complementary nature of fundamental and technical factors in equity valuation exercises is provided via a discussion of the results of fitting our hybrid models (Section 5.4). Finally, the chapter concludes with a comparison of the explanatory power of our hybrid models relative to those incorporating solely fundamental or technical factors, providing further evidence that models incorporating both sets of factors are more powerful than those including either class in isolation (Section 5.5).

5.2 Fundamental Models

To provide Australian evidence on the relationship between price and fundamental factors, and to allow comparison of our findings with those reported in the extant literature, we fit Models (1) and (2), with results presented in Table 5.1.

Table 5.1: Australian Results of Fitting Fundamental Models

Table 5.1 presents the results in Australian dollars of fitting Models (1) and (2), below, with heteroscedasticity and autocorrelation consistent t-statistics provided in parentheses.

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \quad (1)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \quad (2)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecast in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	(1)	(2)
Intercept	0.5104	0.2137
	(2.9773***)	(1.9023)
$BVPS_t$	1.7070	1.1736
	(15.9036***)	(4.9231***)
EPS_t	1.3940	0.7747
	(2.0205**)	(1.2020)
$FEPS_{t+1}$		5.5981
		(3.1112***)
Sample	*1,772*	*1,772*
Adjusted R^2	*0.55*	*0.62*
Akaike Info Criterion	*5.2258*	*5.0663*
F-Statistic	*1,090****	*955.7****
Log Likelihood	*-4,627*	*-4,485*

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

The results pertaining to the fitting of Model (1) confirm that price is highly positively dependent on both book value per share and earnings per share. The significance of book value per share in explaining price is consistent with the clean surplus framework proposed by Ohlson (1995); also providing further evidence that book value per share represents the liquidation or adaptation value of the firm's assets (Burgstahler and Dichev, 1997). The positive statistical dependence of price on current earnings per share supports the argument that contemporaneous earnings per share is a proxy for the current value of the firm (Barth *et al*, 1996). Further, this positive dependence of price on both book value per share and earnings per share is consistent with the findings from the extant valuation literature (see, for example, Collins *et al*, 1997). Overall, Model (1) is highly significant, with a F-statistic of 1,090 and an adjusted R^2 of 55%.

The results of fitting Model (2) provide further evidence of price being positively statistically dependent on book value per share. Further, the model reveals a significant positive relationship between forecast earnings per share and share price. It is interesting to note, however, that the inclusion of forecast earnings per share in the model sees contemporaneous earnings per share become an insignificant explanator of share price. This finding is consistent with prior studies and supports the argument that forecast earnings per share subsume current earnings figures as well as offering incremental information about the future value of the firm (Dechow *et al*, 1999). Again, as with Model (1), Model (2) is highly significant, with a F-statistic of 955, and an adjusted R^2 of 62%.

5.3 Technical Model

To provide evidence on the power of models solely comprising technical factors to explain price, we fit Model (3). Results of this modelling, presented in Table 5.2, reveal that all technical measures are highly significant in explaining contemporaneous share prices, and are significant in the predicted directions.

Specifically, consistent with the technical trading literature (see, for example, Lo and MacKinlay, 1988 and 1999), contemporaneous share prices exhibit a positive dependence on lagged price. Further, shares exhibiting returns in the six month formation period that place them in the top (bottom) performance decile continue to enjoy similar positive (negative) performance in the subsequent six months. This persistence results in systematically higher (lower) prices for these particular firms at the time we model price, namely at the conclusion of the twelve-month period, and is consistent with the performance persistence documented by the momentum literature (see, for example, Jegadeesh and Titman, 1993 and 2001). Overall, the model is highly significant, with a F-statistic of 2,125 and an adjusted R^2 of 78%.

Table 5.2: Australian Results of Fitting Models Including Technical Factors

Table 5.2 presents the results in Australian dollars of fitting Models (3) through (5), below, with heteroscedasticity and autocorrelation consistent t-statistics provided in parentheses.

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \quad (3)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecast in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	(3)	(4)	(5)
Intercept	0.9744	0.1833	0.0599
	(5.4759***)	(2.1613**)	(0.8182)
$BVPS_t$		0.6314	0.4656
		(5.2364***)	(3.4207***)
EPS_t		0.4737	0.2662
		(1.6343)	(0.9342)
$FEPS_{t+1}$			2.5083
			(2.0625**)
P_{t-5}	0.7815	0.6174	0.5757
	(17.9774***)	(9.4853***)	(8.5304***)
D_{Up}	1.2722	1.5962	1.5667
	(4.3879***)	(5.5882***)	(4.6510***)
D_{Down}	-2.3515	-1.3996	-1.2396
	(-4.7107***)	(-3.9728***)	(-3.7863***)
Sample	*1,772*	*1,772*	*1,772*
Adjusted R^2	*0.78*	*0.82*	*0.83*
Akaike Info Criterion	*4.5026*	*4.3107*	*4.2413*
F-Statistic	*2,125****	*1,623****	*1,472****
Log Likelihood	*-3,985*	*-3,813*	*-3,751*

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

5.4 Hybrid Models

The results of fitting our hybrid models, Models (4) and (5), are presented in Table 5.2. Findings pertaining to Model (4) provide further evidence of the importance of book value per share in explaining contemporaneous share price. This positive dependence is consistent with the extant literature which argues that book value represents the liquidation or adaptation value of the firm's assets (Berger *et al,* 1996). However, including the technical measures sees contemporaneous earnings become an insignificant explanator of share price, suggesting that our technical factors subsume value relevant information contained in current earnings.

In regards to the technical factors, consistent with Lo and MacKinlay (1988 and 1999), the findings of Model (4) again confirm the positive dependence of past share price on contemporaneous price. In addition, both momentum dummies are highly significant in explaining price, and are significant in the expected direction. Moreover, shares exhibiting past return performance continue to experience similar performance in the subsequent six months. This positive (negative) persistence results in higher (lower) prices for the top (bottom) performers at the time we model price, at the end of the twelve-month testing period. This finding is consistent with the momentum literature (see, for example, Jegadeesh and Titman, 1993 and 2001).

Further, the inclusion of the three technical measures sees a marked improvement in the explanatory power of the valuation model. Specifically, Model (4) is highly significant, with a F-statistic of 1,623 and an adjusted R^2 of 82%. This dramatic increase in R^2 from 55% in Model (1) to 82% in Model (4) provides preliminary evidence on the complementary nature of fundamental and technical factors in equity valuation exercises.

Our findings are further verified by fitting Model (5), which confirms the results of testing Model (2) and provides additional support for the incremental importance of technical information in valuation models. Results further highlight the significance of both book value per share and forecast earnings per share in explaining contemporaneous share price, but sees current earnings per share remain insignificant.

Similar to Model (4), the technical factors are all highly significant, with the coefficients on the dummy variables being in the expected direction. Overall, Model (5) is highly significant with a F-statistic of 1,472 and has an adjusted R^2 of 83%. It is also evident that the inclusion of the technical factors has seen a substantial increase in the model's R^2, from 62% in Model (2) to 83% in Model (5). This increase in explanatory power is further evidence of the complementary nature of fundamental and technical analysis.

5.5 Evaluating the Relative Strength of the Models

To compare the power of the models overall, we initially compare their adjusted R^2 values: As all models have the same dependent variable, comparing the adjusted R^2 values is meaningful. However, to further confirm our findings, we also examine the models' AIC estimates, which we argue are more robust in light of their ability to account for entropy as well as a given model's fit. It is evident from the values of the adjusted R^2 and AIC that Models (1) through (5) are of increasingly good fit. Specifically, the R^2 values increase from 55% in Model (1) to 83% in Model (5). This marked increase in the power of the overall models is further confirmed by the

examination of AIC values, which decreases considerably through Models (1) to (5) from 5.2258 in Model (1) to 4.2413 in Model (5).

Despite the above findings, the important question, not answered by examining R^2 or AIC values, is whether the fitting of a hybrid model, one that includes both fundamental and technical measures, sees a *statistically significant* improvement in the ability to explain contemporaneous share prices relative to models only comprising fundamental or technical factors. We resolve this issue by calculating likelihood ratios, which are presented in Table 5.3. Overall, in comparing these ratios we confirm that the hybrid models provide a statistically significant increase in explanatory power relative to fundamental or technical models. These results provide more definitive evidence of the complementary nature of fundamental and technical information, as models incorporating both sets of information are better able to explain contemporaneous share prices that those considering either in isolation.

Table 5.3: Australian Results of Likelihood Ratio Testing

Table 5.3 presents the likelihood ratios calculated to compare the strength of unrestricted models tested in this paper relative to restricted models. Specifically, ratios are calculated as 2 (log likelihood of the unrestricted model – log likelihood of the restricted model), and resultant ratios compared to critical χ^2 values with degrees of freedom equal to the number of parameters by which the restricted model differs from the unrestricted model. For ease of reference, the list of all models considered in the paper and included in calculations of likelihood ratios is as follows:

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \quad (1)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \quad (2)$$

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \quad (3)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Notation employed in equations (1) to (5) is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; and, D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0.

		Unrestricted Model		
		(2)	(4)	(5)
Restricted Model	(1)	285***	1,468***	1,753***
	(2)			1,468***
	(3)		469***	469***
	(4)			125***

*** Denotes significance at the 1% level.

5.6 Conclusion

Chapter Five presents the results of fitting the fundamental, technical and hybrid models to a dataset of listed Australian companies and provides strong evidence of the complementary nature of fundamental and technical measures in explaining contemporaneous price. Initially, to ensure comparability of our study with extant literature, the chapter considers the ability of models solely comprising fundamental factors. Results are consistent with previous studies, revealing the positive dependence of price on book value per share and earnings per share (see, for example, Collins *et al*, 1997). Further, consistent with Dechow *et al* (1999), the inclusion of forecast earnings into model fitting sees earnings per share ceasing to significant in explaining share prices.

Thereafter, the chapter evaluates the strength of a model that only incorporates technical factors in explaining price. Results of this testing confirms the positive dependence of past share price on contemporaneous price, a finding consistent with Lo and Mackinlay (1988 and 1999). Further, consistent with the momentum literature, testing reveals the significance of both momentum dummies in explaining price (see, for example, Jegadeesh and Titman, 1993 and 2001).

Next we consider the ability of our hybrid models to explain contemporaneous share prices and, in doing so, provide the first evidence of the complementary nature of fundamental and technical factors in equity valuation exercises. More specifically, we find that augmenting fundamental models with our suite of technical factors sees a marked increase (decrease) in adjusted R^2 values (AIC values), with the likelihood ratios confirming the significance of these changes. Overall, these results confirm that fundamental and technical factors act as

complements rather than substitutes in equity valuation exercises in an Australian context.

Chapter Six: United States Results

6.1 Introduction

Chapter Six presents the results pertaining to our US dataset. We commence by considering models examining fundamental factors in isolation (Section 6.2). Following this, we evaluate the significance of technical factors in explaining contemporaneous share prices of US listed companies (Section 6.3). Subsequently, we examine the complementary nature of fundamental and technical factors in equity valuation exercises by considering our hybrid models (Section 6.4). Lastly, to provide further evidence on the complementary nature of fundamental and technical analysis we compare the explanatory power of our hybrid models with those models only considering either type of factors in isolation (Section 6.5).

6.2 Fundamental Models

Prior to considering whether fundamental and technical analyses complement one another in the context of equity valuation exercises, we examine the explanatory power of each type of analysis in isolation. We commence by discussing the results of fitting Models (1) and (2) in the US, which explain price solely as a function of fundamental factors. These results are formally presented in Table 6.1.

Table 6.1: United States Results of Fitting Fundamental Models

Table 6.1 presents the results in US dollars of fitting Models (1) and (2), below, with heteroscedasticity and autocorrelation consistent t-statistics provided in parentheses.

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \quad (1)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \quad (2)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	(1)	(2)
Intercept	8.26 (34.85***)	7.37 (34.94***)
$BVPS_t$	0.91 (24.07***)	0.51 (16.69***)
EPS_t	1.54 (4.91***)	0.17 (1.83)
$FEPS_{t+1}$		4.94 (17.78***)
Sample	*33,028*	*33,028*
Adjusted R^2	0.35	0.42
Akaike Info Criterion	7.62	7.50
F-Statistic	8,820***	8,095***
Log Likelihood	-125,890	-123,854

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

With respect to Model (1), testing reveals that price is highly positively dependent on book value per share, a finding consistent with the clean surplus valuation framework advanced by Ohslon (1995), the liquidity and adaptation value of assets argument and the results of prior empirical testing (see, for example, Collins *et al*, 1997; Dechow *et al*, 1999; and, Ely and Waymire, 1999). Testing also reveals that price exhibits a highly positive statistical dependence on current earnings per share. Again, this finding is consistent with the extant literature (see, for example, Easton, 1985; Collins *et al*, 1997; Dechow *et al*, 1999; and, Ely and Waymire, 1999) and the argument that earnings per share serves as a proxy of the firm's value in use. Furthermore, the findings pertaining to Model (1) in the US are consistent with the Australian results in Section 5.2. Overall, the model is highly significant with a F-statistic of 8,820 and an adjusted R^2 of 35%.

The results of fitting Model (2) differ somewhat from those pertaining to Model (1). Specifically, while the inclusion of consensus forecast earnings per share does not alter findings with respect to book value, its introduction sees contemporaneous earnings become an insignificant explanator of share price. Instead, the forecast earnings measure itself is revealed as a significant and positive explanator of price. These findings are consistent with Dechow *et al* (1999), who argue that forecast earnings per share not only subsumes current earnings figures, but also offers incremental information about the ongoing value of the firm.

Notwithstanding these differences, Model (2) is highly significant in explaining equity prices, with a F-statistic of 8,095 and an adjusted R^2 of 42%. Further, our Model (2) findings for US companies is consistent with the results of empirical testing performed on the Australian dataset in Section 5.2. Specifically, consistent

with Dechow *et al* (1999), both datasets highlight that earnings forecasts contain important information about the future prospects of the firm.

6.3 Technical Model

Next, in considering the ability of technical analysis to explain contemporaneous price in the US, we examine the results of fitting Model (3), which are presented in Table 6.2. Results show that, consistent with the Australian dataset (Section 5.3), all technical factors are highly significant in explaining contemporaneous price and are significant in the predicted directions.

Specifically, not only do contemporaneous prices exhibits a positive dependence on lagged prices, shares exhibiting returns in the six month formation period that place them in the top (bottom) performance decile continue to enjoy similar positive (negative) performance in the subsequent six months. This persistence results in systematically higher (lower) prices for these particular firms at the time we model price, namely at the conclusion of the twelve-month period, and is consistent with the performance persistence documented by the momentum literature (see, for example, Jegadeesh and Titman, 1993; and, Jegadeesh and Titman, 2001). Moreover, the overall model is highly significant with a F-statistic of 33,400 and an adjusted R^2 of 75%. Interestingly, results suggest that technical analysis has a greater ability to explain equity values in isolation than fundamental analysis.

Table 6.2: United States Results of Fitting Models Including Technical Factors

Table 6.2 presents the results in US dollars of fitting Models (3) through (5), below, with heteroscedasticity and autocorrelation consistent t-statistics provided in parentheses.

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \quad (3)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	(3)	(4)	(5)
Intercept	2.11 (11.74***)	1.68 (10.59***)	1.65 (11.51***)
$BVPS_t$		0.13 (9.06***)	0.05 (3.97***)
EPS_t		0.51 (4.50***)	0.16 (2.84***)
$FEPS_{t+1}$			*1.42* *(9.23***)*
P_{t-5}	*0.90* *(71.27***)*	*0.83* *(49.44***)*	*0.80* *(44.07***)*
D_{Up}	*0.91* *(3.29***)*	*1.43* *(5.32***)*	*1.45* *(5.61***)*
D_{Down}	*-1.28* *(-8.30***)*	*-0.65* *(-3.88***)*	*-0.45* *(-3.37***)*
Sample	*33,028*	*33,028*	*33,028*
Adjusted R^2	0.75	0.76	0.77
Akaike Info Criterion	6.66	6.62	6.60
F-Statistic	33,400***	20,960***	18.020***
Log Likelihood	-109,922	-109,361	-108,970

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

6.4 Hybrid Models

Whilst the preceding discussion provides US evidence of the explanatory power of both fundamental and technical analysis in isolation, it says nothing about whether they act as complements in equity valuation exercises. We provide evidence on this by fitting Models (4) and (5), with results of this testing provided in Table 6.2.

With respect to the former, results reveal the significance of both types of analysis in explaining share price. More specifically, consistent with the findings in relation to Model (1) and the extant literature (see, for example, Collins *et al*, 1997; and, Ely and Waymire, 1999), book value per share and earnings per share are significant positive explanators of contemporaneous share price.

Further, consistent with Model (3), testing reveals the importance of technical analysis even in the presence of fundamental factors, with lagged price and both momentum dummies remaining significant in explaining contemporaneous price. These Model (4) findings for the US coincide with the Australian results (Section 5.4), showing the importance of both fundamental and technical measures as explanators of share price. Additionally, Model (4) is highly significant with a F-statistic of 20,960, and has an adjusted R^2 of 76%.

As with Model (4), the results of fitting Model (5) lend support to the complementary relationship between fundamental and technical analysis, confirming the significance of each type of measure even given the presence of the other. Interestingly, in the context of our hybrid model, the inclusion of the forecast earnings per share does not detract from the significance of the contemporaneous earnings measure in explaining price. This finding is at odds with that of Dechow *et*

al (1999), who report that forecast earnings per share subsume the information contained in the current earnings measure.

Furthermore, the US results differ to that of the Australian findings for Model (5) (Section 5.4). Specifically, the Australian findings concur with those of Dechow *et al* (1999), with earnings per share insignificant with the inclusion of forecast earnings per share in model fitting. Despite this point of difference, Model (5) is highly statistically significant with a F-statistic of 18,020 and an adjusted R^2 of 77%.

6.5 Evaluating the Relative Strength of the Models

To more comprehensively evaluate the relative explanatory power of Models (1) to (5), we augment the ensuing analysis of adjusted R^2 measures with a consideration of AIC values, with both measures included in Tables 6.1 and 6.2. We do this as, even though the response variable in all models is identical, and therefore a comparison of their R^2 values is meaningful, this goodness-of-fit measure is deficient insofar as it fails to adequately consider entropy as well as a model's fit.

Consequently, we also undertake a comparison of models' AIC estimates, which have the added benefit of greater suitability in large samples. Examination of R^2 and AIC values reveals that Models (1) through (5) are of increasingly good fit, as evidenced by a marked increase in the former and decrease in the latter. Moreover, the inclusion of both fundamental and technical analyses in valuation models sees an increase in R^2 measures relative to Models (1) to (3), and a corresponding drop in AIC values.

Despite the preceding discussion, the critical question is whether fitting a hybrid model sees a *statistically significant* improvement in the ability to explain contemporaneous price relative to fitting models comprising either fundamental or technical factors in isolation. An answer is provided via consideration of the likelihood ratios reported in Table 6.3.

A comparison of these ratios confirms that hybrid models provide a statistically significant increase in explanatory power relative to fundamental or technical models. In further robustness testing, we rerun the regressions outlined in Table 6.3, using change in price as the dependent variable (see, for example, Beaver *et al*, 1980; and, Barth *et al*, 1990). Inferences regarding the complementary nature of fundamental and technical analysis remain unchanged, although the explanatory power of the resultant models is markedly lower.

Taken as a whole, our findings not only reveal the complementary nature of fundamental and technical information, but serve to highlight the benefits of including both analyses in equity valuation exercises. These findings in the US are consistent with the Australian results in Section 5.5, highlighting the superiority of hybrid valuation models.

Table 6.3: United States Results of Likelihood Ratio Testing

Table 6.3 presents the likelihood ratios calculated to compare the strength of unrestricted models tested in this paper relative to restricted models. Specifically, ratios are calculated as 2 (log likelihood of the unrestricted model – log likelihood of the restricted model), and resultant ratios compared to critical χ^2 values with degrees of freedom equal to the number of parameters by which the restricted model differs from the unrestricted model. For ease of reference, the list of all models considered in the paper and included in calculations of likelihood ratios is as follows:

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \quad (1)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \quad (2)$$

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \quad (3)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Notation employed in equations (1) to (5) is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; and, D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0.

		Unrestricted Model		
		(2)	(4)	(5)
Restricted Model	(1)	4,072***	33,058***	33,840***
	(2)			29,768***
	(3)		1,122***	1,904***
	(4)			782***

*** Denotes significance at the 1% level.

6.6 Conclusion

This chapter commences by considering the ability of models fitting fundamental and technical factors in isolation. Results of fitting fundamental models, consistent with the extant literature (see, for example, Collins *et al*, 1997; and, Ely and Waymire, 1999), reveals the positive dependence of price on book value per share and earnings per share. Furthermore, in agreement with Dechow *et al* (1999) the inclusion of forecast earnings per share in model fitting sees earnings per share become insignificant in explaining contemporaneous price. Subsequently, we consider a model that consists solely of technical factors, with results highlighting contemporaneous share prices dependence on lagged price, and the two momentum dummy variables.

Consistent with the Australian results, testing within the US further confirms the complementary nature of fundamental and technical analysis by showing that, while each performs well in isolation, models integrating both have superior explanatory power: The integration of both analyses in equity valuation models sees considerable increases in adjusted R^2 values and marked drops in corresponding AIC figures, with the significance of our results further verified by the highly significant results of likelihood ratio testing.

Chapter Seven: International Results

7.1 Introduction

The previous two chapters examine the complementary nature of fundamental and technical analysis on Australian (Chapter Five) and US (Chapter Six) datasets. In this chapter, to provide international evidence, we extend this analysis by considering nine countries, namely: Australia; Canada; France; Germany; Hong Kong; Japan; Singapore; the UK; and, the US. Specifically, we examine these countries on an individual basis, as well as in aggregate.

Moreover, to allow for the possibility that fundamental and technical analyses are not complementary, we commence by modelling price solely as a function of fundamental factors (Section 7.2). Thereafter, we consider the ability of technical factors to explain contemporaneous share prices (Section 7.3). Next, we fit our hybrid models (Section 7.4) and, consider the performance of these models relative to those modelling price solely as a function of either fundamental or technical factors (Section 7.5). Lastly, we re-perform testing on the pooled sample with the inclusion of dummy variables to identify differences between the US and other countries (Section 7.6).

7.2 Fundamental Models

Before evaluating the complementary nature of fundamental and technical analysis in valuation exercises, we examine the explanatory power of each type of analysis in isolation. Specifically, we commence by assessing the results of the two fundamental models, namely, Models (1) and (2). Table 7.1 and Table 7.2 report the

results for Models (1) and (2), respectively, for the individual countries and the pooled sample.

In regards to Model (1), testing reveals that across all nine countries, price is highly positively dependent on book value per share. This finding is consistent with the clean surplus valuation framework advanced by Ohslon (1995), the liquidity and adaptation value of assets argument, and the results of prior empirical testing (see, for example, Joos and Lang, 1994; Collins *et al*, 1997; Dechow *et al*, 1999; Ely and Waymire, 1999; and, Ota, 2002). Further, results for all countries except Hong Kong find that price is positively dependent on current earnings per share. Again, this finding is consistent with the extant literature (see, for example, Easton, 1985; Joos and Lang, 1994; Collins *et al*, 1997; Dechow *et al*, 1999; Ely and Waymire, 1999; and, Ota, 2002) and the argument that earnings per share serves as a proxy of the firm's value in use.

Furthermore, the individual country findings are consistent with the results obtained from the pooled sample. Overall, all results for Model (1) are highly significant with F-statistics ranging from 447 (Germany) to 8,820 (US), and 37,220 for the pooled sample. In addition, the countries have adjusted R^2 values ranging from 35% (US) to 62% (Hong Kong), with the pooled sample reporting an adjusted R^2 value of 59%.

Table 7.1: International Results of Fitting Fundamental Model (1)

Table 7.1 presents the results of fitting Model (1), below, for all countries and the pooled sample. Results for the individual countries are reported in their home currencies, while the pooled sample results are reported in US dollars. Heteroscedasticity and autocorrelation consistent t-statistics are provided in parentheses.

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \quad (1)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; and, EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes.

Variables	*Country*									*Pooled Countries*
	Australia	*Canada*	*France*	*Germany*	*Hong Kong*	*Japan*	*Singapore*	*United Kingdom*	*United States*	
Intercept	0.51 (2.97***)	7.27 (5.48***)	16.06 (11.28***)	19.61 (2.12**)	2.01 (5.54***)	172.20 (0.72)	0.31 (3.52***)	135.01 (18.48***)	8.26 (34.85***)	10.59 (8.35***)
$BVPS_t$	1.71 (15.90***)	1.17 (7.49***)	0.83 (15.45***)	1.44 (3.53***)	0.81 (7.43***)	2.41 (46.03***)	0.82 (6.94***)	0.91 (10.48***)	0.91 (24.07***)	1.47 (12.99***)
EPS_t	1.39 (2.02**)	1.36 (2.74***)	1.81 (5.04***)	3.30 (4.39***)	2.17 (1.58)	1.02 (9.71***)	5.90 (3.12***)	3.45 (4.11***)	1.54 (4.91***)	2.94 (3.67***)
Sample	*1,772*	*1,252*	*1,564*	*941*	*1,672*	*7,379*	*926*	*3155*	*33,028*	51,689
Adjusted R^2	*0.55*	*0.60*	*0.52*	*0.49*	*0.62*	*0.51*	*0.58*	*0.39*	0.35	0.59
Akaike Info Criterion	*5.23*	*9.84*	*8.98*	*11.36*	*7.33*	*22.68*	*4.39*	*13.81*	7.62	12.47
F-Statistic	*1,090****	*922****	*860****	*447****	*1,360****	*3,795****	*636****	*1,001****	8,820***	37,220***
Log Likelihood	*-4,627*	*-6,154*	*-7,019*	*-5,339*	*-6,120*	*-83,683*	*-2,030*	*-21,776*	-125,890	-322,304

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

Table 7.2: International Results of Fitting Fundamental Model (2)

Table 7.2 presents the results of fitting Model (2), below, for all countries and the pooled sample. Results for the individual countries are reported in their own currency, while the pooled sample results are reported in US dollars. Heteroscedasticity and autocorrelation consistent t-statistics are provided in parentheses.

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \quad (2)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variables	*Country*									*Pooled Countries*
	Australia	*Canada*	*France*	*Germany*	*Hong Kong*	*Japan*	*Singapore*	*United Kingdom*	*United States*	
Intercept	0.21 (1.90)	9.93 (5.47***)	13.25 (8.82***)	11.28 (2.77***)	0.69 (3.33***)	853.64 (4.32***)	0.27 (3.27***)	66.99 (8.40***)	7.37 (34.94***)	5.31 (6.37***)
$BVPS_t$	1.17 (4.92***)	1.25 (6.50***)	0.46 (11.68***)	0.68 (2.26**)	0.26 (4.76***)	0.85 (24.67***)	0.81 (6.96***)	0.38 (5.36***)	0.51 (16.69***)	0.63 (3.70***)
EPS_t	0.77 (1.20)	1.21 (2.51**)	0.27 (0.81)	1.59 (1.09)	0.69 (1.31)	0.95 (11.04***)	5.69 (3.09***)	0.10 (0.63)	0.17 (1.83)	-0.14 (-1.08)
$FEPS_{t+1}$	5.60 (3.11***)	-3.15 (-1.41)	5.37 (7.18***)	11.11 (6.21***)	9.59 (13.06***)	28.90 (30.40***)	0.46 (1.22)	9.33 (12.75***)	4.94 (17.78***)	9.99 (9.21***)
Sample	*1,772*	*1,252*	*1,564*	*941*	*1,672*	*7,379*	*926*	*3155*	*33,028*	51,689
Adjusted R^2	*0.62*	*0.60*	*0.60*	*0.63*	*0.82*	*0.67*	*0.59*	*0.57*	0.42	0.71
Akaike Info Criterion	*5.07*	*9.82*	*8.80*	*11.03*	*6.58*	*22.28*	*4.37*	*13.47*	7.50	12.12
F-Statistic	*956****	*631****	*795****	*531****	*2,543****	*4,997****	*442****	*1,365****	8,095***	42,460***
Log Likelihood	*-4,485*	*-6,144*	*-6,873*	*-5,186*	*-5,493*	*-82,200*	*-2,017*	*-21,239*	-123,854	-313,289

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

The results pertaining to Model (2) provide further evidence of price being positively statistically dependent on book value per share across all countries. However, while the inclusion of consensus forecast earnings per share does not alter findings with respect to book value, its introduction sees contemporaneous earnings become an insignificant explanator of share price in six of the nine countries in the study, as well as the aggregate pooled sample. Rather, forecast earnings are a significant and positive explanator of price. This finding is consistent with prior studies and supports the argument that forecast earnings per share subsume current earnings figures, as well as offering incremental information about the future value of the firm (Dechow *et al*, 1999).

Conversely, the results of Model (2) for Canada and Singapore fail to find a significant relationship between forecast earnings and share price. Instead, both countries continue to document a significant positive relationship between current earnings per share and contemporaneous price. Notwithstanding these differences, Model (2) is highly significant in explaining equity prices across all countries, with F-statistics ranging from 442 (Singapore) to 8,095 (US), and 42,460 for the pooled sample. Further, the adjusted R^2 values range from 42% (US) to 82% (Hong Kong), with the pooled sample having an adjusted R^2 of 71%.

7.3 Technical Model

Following the above examination on the relationship between fundamental analysis and price (Section 7.2), we also fit a model where contemporaneous share price is solely a function of technical factors, namely Model (3). The results pertaining to the fitting of Model (3) are presented in Table 7.3.

Table 7.3: International Results of Fitting Technical Model (3)

Table 7.3 presents the results of fitting Model (3), below, with heteroscedasticity and autocorrelation consistent t-statistics provided in parentheses. Results for the individual countries are reported in their own currency, while the pooled sample results are reported in US dollars.

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \quad (3)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; and, D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0.

Variables	*Country*									*Pooled Countries*
	Australia	*Canada*	*France*	*Germany*	*Hong Kong*	*Japan*	*Singapore*	*United Kingdom*	*United States*	
Intercept	0.97 (5.48***)	1.13 (1.24)	10.86 (2.31**)	18.66 (4.31***)	0.30 (2.42**)	1,206.58 (6.77***)	0.01 (0.05)	23.68 (4.24***)	2.11 (11.74***)	5.27 (1.94)
P_{t-5}	0.78 (17.98***)	0.88 (11.18***)	0.72 (5.70***)	1.18 (11.03***)	0.67 (8.41***)	0.71 (47.30***)	0.75 (15.97***)	0.78 (27.16***)	*0.90* *(71.27***)*	*0.95* *(16.09***)*
D_{Up}	1.27 (4.39***)	3.37 (2.58***)	3.75 (2.59**)	12.66 (2.117**)	0.71 (2.63***)	212.34 (0.38)	0.19 (1.25)	16.66 (2.30**)	*0.91* *(3.29***)*	*1.73* *(3.11***)*
D_{Down}	-2.35 (-4.71***)	-5.81 (-2.70***)	-7.83 (-2.54**)	-18.80 (-4.70***)	-0.81 (-3.25***)	728.57 (1.22)	-0.08 (-0.63)	-27.71 (-4.34***)	*-1.28* *(-8.30***)*	*-3.40* *(-2.94***)*
Sample	*1,772*	*1,252*	*1,564*	*941*	*1,672*	*7,379*	*926*	*3155*	*33,028*	51,689
Adjusted R^2	*0.78*	*0.93*	*0.72*	*0.72*	*0.94*	*0.77*	*0.89*	*0.90*	0.75	0.90
Akaike Info Criterion	*4.50*	*8.15*	*8.45*	*10.76*	*5.44*	*21.92*	*3.03*	*11.99*	6.66	11.04
F-Statistic	*2,125****	*5,166****	*1,341****	*800****	*9,143****	*8,278****	*2,561****	*9,941****	33,400***	158,200***
Log Likelihood	*-3,985*	*-5,096*	*-6,603*	*-5,057*	*-4,540*	*-80,854*	*-1,397*	*-18,914*	-109,922	-285,390

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

Results show that across seven of the nine countries, as well as the pooled sample, all technical factors are highly significant in explaining contemporaneous price and are significant in the predicted directions. However, in two countries, namely, Japan and Singapore, shares do not exhibit performance persistence, with the dummy variables failing to be significant in model fitting. This finding is consistent with Griffin *et al* (2003), who fail to find evidence of momentum in either Japan or Singapore.

Specifically, for all countries and the pooled sample, consistent with Lo and MacKinlay (1988 and 1999), we see that contemporaneous prices exhibit a positive dependence on lagged prices. In addition, we see that for the majority of countries, shares exhibiting returns in the six month formation period that place them in the top (bottom) performance decile continue to enjoy similar positive (negative) performance in the subsequent six months.

This persistence results in systematically higher (lower) prices for these particular firms at the time we model price, namely at the conclusion of the twelve-month period, and is consistent with the performance persistence documented by the momentum literature (see, for example, Jegadeesh and Titman, 1993 and, 2001 for US evidence; Liu *et al*, 1999 for momentum findings in the UK; Rouwenhorst, 1998 and Nijman *et al*, 2002 for evidence of momentum profits in Europe; and, Rouwenhorst, 1999 and Griffin *et al*, 2003 for evidence in a number of developing markets). Surprisingly, however, in contrast to Griffin *et al*, 2003, we document performance persistence in Hong Kong.

Overall, the results for Model (3) for all countries and the pooled sample are highly significant with F-statistics ranging from 800 (Germany) to 33,400 (US), and 158,200 for the pooled sample. Furthermore, the adjusted R^2 values range from 72% (France and Germany) to 94% (Hong Kong), with the pooled sample reporting an adjusted R^2 value of 90%.

7.4 Hybrid Models

Whilst the preceding sections provide an international examination on the explanatory power of both fundamental and technical analysis in isolation, it says nothing about whether they act as complements in equity valuation exercises. We provide evidence on this by fitting Models (4) and (5), with results presented in Table 7.4 and 7.5, respectively.

Results pertaining to Model (4) reveal the significance of both types of analysis in explaining share price. In respect to fundamental analysis, the findings for France, Japan, the UK and the US are consistent with the findings from fitting Model (1) in these countries. More specifically, inline with the extant literature (see, for example, Collins *et al*, 1997; and, Ely and Waymire, 1999), book value per share and earnings per share are significant positive explanators of contemporaneous share price.

Interestingly, when fundamental and technical variables are included in modelling, the earnings per share variables become insignificant for both Australia and Germany. Furthermore, results from fitting Model (4) in Canada, Hong Kong and Singapore sees book value per share ceasing to be important in explaining

contemporaneous price. We argue these results are due to the information content contained in technical factors subsuming the fundamental variables.

Further, consistent with Model (3), testing reveals the importance of technical analysis even in the presence of fundamental factors. Consistent with the findings in Section 7.3, all countries find that lagged price is significant in explaining contemporaneous price. In addition, the results for all countries, except Japan and Singapore, find that both momentum dummies are highly significant in explaining price, and are significant in the expected directions. Overall, for all countries, Model (4) is highly significant with F-statistics ranging from 614 (Germany) to 20,960 (US), with the pooled sample reporting a F-statistic of 110,000. Further, the adjusted R^2 values range from 76% (France and the US) to 94% (Hong Kong), with the pooled sample having a adjusted R^2 of 91%.

As with Model (4), the results of fitting Model (5) lends support to the complementary relationship between fundamental and technical analysis, confirming the significance of each type of measure even given the presence of the other. Consistent with the findings from Model (2) for Australia, France and Germany, book value per share and forecast earnings per share are significant positive explanators in explaining contemporaneous share price, but current earnings per share remain insignificant. This result concurs with the findings of Dechow *et al* (1999), who argue that forecast earnings per share subsume the information contained in the current earnings measure.

Table 7.4: International Results of Fitting Hybrid Model (4)

Table 7.4 presents the results of fitting Model (4), below, with heteroscedasticity and autocorrelation consistent t-statistics provided in parentheses. Results for the individual countries are reported in their own currency, while the pooled sample results are reported in US dollars.

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; and, D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0.

Variables	*Country*									*Pooled Countries*
	Australia	*Canada*	*France*	*Germany*	*Hong Kong*	*Japan*	*Singapore*	*United Kingdom*	*United States*	
Intercept	0.18 (2.16**)	1.35 (1.64)	8.85 (2.83***)	8.80 (2.17**)	0.26 (2.08**)	150.13 (0.99)	-0.01 (-0.05)	17.16 (3.63***)	1.68 (10.59***)	2.32 (2.61***)
$BVPS_t$	0.63 (5.24***)	-0.07 (-0.98)	0.28 (2.34**)	0.68 (2.61***)	0.01 (0.40)	1.03 (52.17***)	0.01 (0.27)	0.07 (2.64***)	0.13 (9.06***)	0.28 (4.22***)
EPS_t	0.47 (1.63)	0.18 (2.53**)	0.98 (3.25***)	0.60 (0.52)	0.39 (1.44)	0.74 (12.19***)	1.34 (6.77***)	0.52 (2.79***)	0.51 (4.50***)	0.85 (3.05***)
P_{t-5}	0.62 (9.49***)	0.88 (8.09***)	0.56 (3.46***)	0.84 (8.40***)	0.77 (8.40***)	0.57 (40.99***)	0.78 (13.14***)	0.74 (24.64***)	*0.83* *(49.44***)*	*0.83* *(8.94***)*
D_{Up}	1.60 (5.59***)	3.07 (2.47**)	4.09 (2.53**)	14.62 (2.92***)	0.65 (2.30**)	860.01 (1.83)	0.19 (1.80)	22.46 (3.10***)	*1.43* *(5.32***)*	*4.85* *(4.32***)*
D_{Down}	-1.40 (-3.97***)	-4.79 (-2.29**)	-5.09 (-2.66***)	-13.50 (-2.86***)	-0.73 (-2.74***)	445.47 (0.88)	-0.04 (-0.32)	-19.18 (-3.48***)	*-0.65* *(-3.88***)*	*-0.72* *(-2.98***)*
Sample	*1,772*	*1,252*	*1,564*	*941*	*1,672*	*7,379*	*926*	*3155*	*33,028*	51,689
Adjusted R^2	*0.82*	*0.93*	*0.76*	*0.77*	*0.94*	*0.83*	*0.90*	*0.90*	0.76	0.91
Akaike Info Criterion	*4.31*	*8.13*	*8.29*	*10.58*	*5.41*	*21.59*	*2.98*	*11.96*	6.62	10.91
F-Statistic	*1,623****	*3,166****	*999****	*614****	*5,637****	*7,493****	*1,624****	*5,887****	20,960***	110,000***
Log Likelihood	*-3,813*	*-5,083*	*-6,476*	*-4,970*	*-4,517*	*-79,633*	*-1,373*	*-18,866*	-109,361	-281,923

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

Table 7.5: International Results of Fitting Hybrid Model (5)

Table 7.5 presents the results of fitting Model (5), below, with heteroscedasticity and autocorrelation consistent t-statistics provided in parentheses. Results for the individual countries are reported in their own currency, while the pooled sample results are reported in US dollars.

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t; $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; and, D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0.

Variables	*Country*									*Pooled Countries*
	Australia	*Canada*	*France*	*Germany*	*Hong Kong*	*Japan*	*Singapore*	*United Kingdom*	*United States*	
Intercept	0.06 (0.82)	1.34 (2.06**)	8.18 (3.12***)	5.07 (1.72)	0.05 (0.40)	246.83 (1.86)	-0.01 (-0.15)	11.31 (2.58***)	1.65 (11.51***)	1.48 (3.23***)
$BVPS_t$	0.47 (3.42***)	-0.07 (-1.01)	0.14 (3.14***)	0.34 (2.44**)	0.01 (0.09)	0.40 (18.27***)	0.01 (0.34)	0.02 (1.07)	0.05 (3.97***)	0.13 (2.72***)
EPS_t	0.27 (0.93)	0.18 (2.70***)	0.26 (0.74)	0.01 (0.01)	0.33 (1.27)	0.74 (13.95***)	1.33 (6.72***)	0.09 (1.05)	0.16 (2.84***)	0.13 (3.07***)
$FEPS_{t+1}$	2.51 (2.06**)	0.01 (0.01)	3.74 (1.79**)	6.49 (7.02***)	1.15 (2.61***)	15.50 (48.60***)	0.07 (1.40)	1.61 (3.84***)	*1.42* *(9.23***)*	*2.87* *(3.07***)*
P_{t-5}	0.58 (8.53***)	0.88 (7.40***)	0.51 (3.13***)	0.80 (7.40***)	0.80 (9.04***)	0.48 (39.09***)	0.78 (12.20***)	0.72 (15.26***)	*0.80* *(44.07***)*	*0.76* *(7.77***)*
D_{Up}	1.57 (4.65***)	3.07 (2.37**)	3.60 (2.25**)	12.12 (2.33**)	0.67 (2.40**)	-129.14 (-0.31)	0.20 (1.89)	23.52 (3.29***)	*1.45* *(5.61***)*	*5.05* *(4.63***)*
D_{Down}	-1.24 (-3.79***)	-4.78 (-2.38**)	-5.18 (-3.02***)	-8.75 (-3.02***)	-0.67 (-2.47**)	-483.76 (-1.09)	-0.04 (-0.31)	-18.36 (-3.60***)	*-0.45* *(-3.37***)*	*-1.40* *(-2.80***)*
Sample	*1,772*	*1,252*	*1,564*	*941*	*1,672*	*7,379*	*926*	*3155*	*33,028*	51,689
Adjusted R^2	*0.83*	*0.94*	*0.78*	*0.81*	*0.95*	*0.88*	*0.90*	*0.91*	0.77	0.92
Akaike Info Criterion	*4.24*	*8.12*	*8.21*	*10.38*	*5.39*	*21.31*	*2.98*	*11.92*	6.60	10.81
F-Statistic	*1,472****	*2,636****	*927****	*659****	*4,813****	*8,637*	*1,355****	*5,132****	18.020***	101,600***
Log Likelihood	*-3,751*	*-5,082*	*-6,412*	*-4,876*	*-4,497*	*-78,607*	*-1,371*	*-18,802*	-108,970	-279,490

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

However, interestingly, for Japan and the US, as well as the pooled sample, the inclusion of forecast earnings per share does not detract from the significance of the contemporaneous earnings measure in explaining price. Furthermore, for both Hong Kong and the UK, the inclusion of forecast earnings and the technical measures sees both book value per share and earnings per share become insignificant in modelling. Results pertaining to Canada and Singapore highlight the only significant fundamental measure as earnings per share.

Similar to Model (4), except for Japan and Singapore, the technical factors are all highly significant, with the coefficients on the dummy variables being in the expected direction. Overall, across all countries and the pooled sample, Model (5) is highly statistically significant with F-statistics ranging from 659 (Germany) to 18,020 (US), with the pooled sample having a F-statistic of 101,600. In addition, the adjusted R^2 values range from 77% (US) to 95% (Hong Kong), with the pooled sample having an adjusted R^2 of 92%.

7.5 Evaluating the Relative Strength of the Models

To evaluate the relative explanatory power of Models (1) to (5) for all countries and the pooled sample, we augment the ensuing analysis of adjusted R^2 measures with a consideration of AIC values, with both measures included in Tables 7.1 through 7.4. We do this as, even though the response variable in all models is identical, and therefore a comparison of their R^2 values is meaningful, this goodness-of-fit measure is deficient insofar as it fails to adequately consider entropy as well as a model's fit.

Consequently, we also undertake a comparison of models' AIC estimates, which have the added benefit of greater suitability in large samples. Overall, an examination of the R^2 and AIC values for the individual countries and the pooled sample reveals that Models (1) through (5) are of increasingly good fit, as evidenced by a marked increase in the former and decrease in the latter. Moreover, the inclusion of both fundamental and technical variables in model fitting corresponds to an increase in R^2 measures relative to Models (1) to (3), and a drop in AIC values.

However, whilst the above discussion highlights the increasing explanatory power of the models, the most important question is whether fitting a hybrid model creates a *statistically significant* improvement in the ability to explain contemporaneous share price relative to fitting models containing either fundamental or technical factors in isolation. To answer this, we consider likelihood ratios, which compare two competing models where one is the nested version of the other (see, for example, Felsenstein, 1981; Huelsenbeck and Crandall, 1997; and, Huelsenbeck and Rannala, 1997). We present the results of these likelihood ratios in Table 7.6.

Table 7.6: International Results of Likelihood Ratio Testing

Table 7.6 presents the likelihood ratios calculated to compare the strength of unrestricted models tested in this paper relative to restricted models. Specifically, ratios are calculated as 2 (log likelihood of the unrestricted model – log likelihood of the restricted model), and resultant ratios compared to critical χ^2 values with degrees of freedom equal to the number of parameters by which the restricted model differs from the unrestricted model. For ease of reference, the list of all models considered in the paper and included in calculations of likelihood ratios is as follows:

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \quad (1)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \quad (2)$$

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \quad (3)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Notation employed in equations (1) to (5) is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; and, D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0.

Models	*Country*									*Pooled Countries*
	Australia	*Canada*	*France*	*Germany*	*Hong Kong*	*Japan*	*Singapore*	*United Kingdom*	*United States*	
(1) vs (2)	285***	20***	91***	305***	1,256***	2,986***	28***	1,075***	4,072***	18,030***
(1) vs (4)	1,468***	2,143***	1,085***	739***	3,209***	8,120***	1,314***	5,821***	33,058***	80,762***
(1) vs (5)	1,753***	2,143***	1,215***	927***	3,248***	10,171***	1,318***	5,950***	33,840***	85,628***
(2) vs (5)	1,468***	2,122***	1,124***	621***	1,992***	7,185***	1,290***	4,875***	29,768***	67,598***
(3) vs (4)	469***	27***	253***	174***	46***	2,443***	47***	96***	1,122***	6,934***
(3) vs (5)	469***	27***	383***	362***	86***	4,994***	52***	226***	1,904***	11,800***
(4) vs (5)	125***	0	129***	188***	39***	2,050***	4**	129***	782***	4,866***

***Denotes significance at the 1% level; and, ** Denotes significance at the 5% level.

A comparison of these ratios across countries confirms that hybrid models provide a statistically significant increase in explanatory power relative to fundamental or technical models. In regards to fundamental Models (1) and (2), the likelihood ratios across all countries, as well as the pooled sample, highlight that fundamental models including forecast earnings per share better explain contemporaneous share price. Specifically, the pooled sample likelihood ratio for the comparison of Models (1) and (2) is 18,030.

However, when comparing these fundamental models to models incorporating both fundamental and technical factors, that is, Model (4) and (5), it is evident that the hybrid models provide a statistically significant increase in explanatory power. Specifically, the likelihood ratio between Model (1) and Model (4), and Model (2) and Model (5), for the pooled sample is 80,762 and 67,598, respectively. In addition, evaluating the explanatory power of Model (3), the technical model, in comparison to Model (4) and Model (5), further highlight the complementary nature of fundamental and technical factors. This is reflected in the statistically significant likelihood ratio results for the pooled sample (6,934 and 11,800 for the likelihood tests comparing Model (3) with Models (4) and (5), respectively).

In comparing Models (4) and (5), the majority of countries, and the pooled sample, find that Model (5) provides a statistically significant increase in explanatory power. Moreover, Canada is the only country whose results indicate that Model (4) is the best model, that is, the hybrid model that does not contain consensus earnings forecasts in fitting. This result is unsurprising given the insignificance of earnings forecasts in model fitting for Canada.

Overall, both on an individual country basis and in the aggregate pooled sample, our findings not only reveal the complementary nature of fundamental and technical information, but serve to highlight the benefits of including both analyses in equity valuation exercises. Specifically, the likelihood ratio tests confirm that the hybrid models do provide a statistically significant increase in explanatory power relative to both fundamental and technical models.

7.6 Does the United States Dominate the Pooled Sample?

This section re-examines the pooled sample by testing Models (1) through (5) with the inclusion of dummy variables to differentiate between the US and other countries in the sample. We perform this testing as the US dominates the pooled sample, with over 65% of the observations being from US listed companies. Initially, we examine models that consider the fundamental variables in isolation. The results for these models are presented in Table 7.7.

In evaluating these results it is important to note that when D_{NonUS} equals zero, the observation is a US listed company, and as such, the values on the coefficients will match those obtained in our US findings (Chapter Six). Results obtained from modelling the fundamental models verify this, with the coefficients of the US companies matching those acquired in Table 6.1.

Table 7.7: Pooled Sample Results of Fitting Fundamental Models Controlling for the United States

Table 7.7 presents the results in US dollars of fitting Models (1) and (2), below, including dummy variables to control for US observations. Heteroscedasticity and autocorrelation consistent t-statistics are provided in parentheses.

$$P_{t+1} = \alpha + \beta_1 D_{NonUS} + \beta_2 BVPS_t + \beta_3 (BVPS_t * D_{NonUS}) + \beta_4 EPS_t + \beta_5 (EPS_t * D_{NonUS}) \quad (1)$$

$$P_{t+1} = \alpha + \beta_1 D_{NonUS} + \beta_2 BVPS_t + \beta_3 (BVPS_t * D_{NonUS}) + \beta_4 EPS_t + \beta_5 (EPS_t * D_{NonUS}) + \beta_6 FEPS_{t+1} + \beta_7 (FEPS_{t+1} * D_{NonUS}) \quad (2)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; D_{NonUS} is a dummy variable equal to 1 if the observation is from a country other than the US, else 1; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	(1)	(2)
Intercept	8.26 (33.29***)	7.37 (33.74***)
D_{NonUS} *Intercept*	17.40 (6.03***)	5.38 (2.60***)
$BVPS_t$	0.91 (23.64***)	0.51 (16.37***)
$D_{NonUS}\,BVPS_t$	0.53 (4.40***)	0.11 (0.62)
EPS_t	1.54 (4.91***)	0.17 (1.83)
$D_{NonUS}\,EPS_t$	1.40 (1.61)	-0.30 (-1.85)
$FEPS_{t+1}$		4.94 (17.85***)
$D_{NonUS}\,FEPS_{t+1}$		5.03 (4.44***)
Sample	*51,689*	*51,689*
Adjusted R^2	*0.59*	*0.71*
Akaike Info Criterion	*12.46*	*12.12*
F-Statistic	*15,100***	*18,270****
Log Likelihood	*-322,082*	*-313,165*

Denotes significance at the 5% level; and,* Denotes significance at the 1% level.

From Table 7.7, we can see that the results from fitting Model (1) with the inclusion of D_{NonUS} changes the coefficient on book value per share for all countries in the sample other than the US, but has no significant impact on the earnings per share coefficient. Specifically, the book value per share coefficient is 0.91 for US companies and 1.44 (0.91 for the US plus an additional 0.53 for D_{NonUS}) for all other companies in the sample. Furthermore, the results confirm earlier findings from the pooled sample, with the positive dependence of contemporaneous share price on book value per share and earnings per share.

In addition, consistent with Dechow *et al* (1999) the inclusion of forecast earnings per share in Model (2) sees contemporaneous earnings ceasing to be a significant explanator of share price. In contrast to the findings of Model (1), the inclusion of D_{NonUS} has no significant impact on book value per share in Model (2), but does have a positive affect on the forecast earnings per share coefficient for all countries in the sample other than the US.

The results pertaining to the technical and hybrid models are reported in Table 7.8. In regards to the technical model, namely, Model (3), the inclusion of D_{NonUS} sees a statistically significant difference on D_{Down} for non-US companies, with the coefficient decreasing from -1.28 to -9.08 (-1.28 for the US plus an additional -7.80 for D_{NonUS}).

Despite controlling for US observations, results obtained for the hybrid models further verify the complementary nature of fundamental and technical analysis. Specifically, for Model (4), all technical factors remain highly significant in the

predicted direction. Further, consistent with the pooled sample findings in Section 7.4; all fundamental factors are significant in explaining contemporaneous price.

Interestingly, the inclusion of D_{NonUS} in Model (4) only affects the momentum dummy variable, D_{Up}. Specifically; the coefficient is statistically significant, increasing by 8.55, from 1.43 to 9.98. Again, this finding is evidenced in Model (5), with D_{Up} having a significantly higher coefficient of 10.36 for non-US companies (1.45 for the US plus an additional 8.91 for D_{NonUS}) in the sample, compared to 1.45 for US companies.

Table 7.8: Pooled Sample Results of Fitting Models Including Technical Factors Controlling for the United States

Table 7.8 presents the results in US dollars of fitting Models (3) through (5), below, including dummy variables to control for US observations. T-statistics in parentheses are heteroscedasticity and autocorrelation consistent.

$$P_{t+1} = \alpha + \beta_1 D_{NonUS} + \beta_2 P_{t-5} + \beta_3 (P_{t-5} * D_{NonUS}) + \beta_4 D_{Up} + \beta_5 (D_{Up} * D_{NonUS}) + \beta_6 D_{Down} + \beta_7 (D_{Down} * D_{NonUS}) \quad (3)$$

$$P_{t+1} = \alpha + \beta_1 D_{NonUS} + \beta_2 BVPS_t + \beta_3 (BVPS_t * D_{NonUS}) + \beta_4 EPS_t + \beta_5 (EPS_t * D_{NonUS}) + \beta_6 P_{t-5} + \beta_7 (P_{t-5} * D_{NonUS}) + \beta_8 D_{Up} + \beta_9 (D_{Up} * D_{NonUS}) + \beta_{10} D_{Down} + \beta_{11} (D_{Down} * D_{NonUS}) \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 D_{NonUS} + \beta_2 BVPS_t + \beta_3 (BVPS_t * D_{NonUS}) + \beta_4 EPS_t + \beta_5 (EPS_t * D_{NonUS}) + \beta_6 FEPS_{t+1} + \beta_7 (FEPS_{t+1} * D_{NonUS}) + \beta_8 P_{t-5} + \beta_9 (P_{t-5} * D_{NonUS}) + \beta_{10} D_{Up} + \beta_{11} (D_{Up} * D_{NonUS}) + \beta_{12} D_{Down} + \beta_{13} (D_{Down} * D_{NonUS}) \quad (5)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; D_{NonUS} is a dummy variable equal to 1 if the observation is from a country other than the US, else 1; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	(3)	(4)	(5)
Intercept	2.11	1.68	1.65
	(11.29***)	(10.17***)	(11.06***)
D_{NonUS} *Intercept*	11.12	4.98	2.90
	(1.81)	(2.38**)	(2.67***)
$BVPS_t$		0.13	0.05
		(8.93***)	(3.94***)
$D_{NonUS}\,BVPS_t$		0.14	0.08
		(1.09)	(1.16)
EPS_t		0.51	0.16
		(4.49***)	(2.83***)
$D_{NonUS}\,EPS_t$		0.34	-0.03
		(0.89)	(-0.25)
$FEPS_{t+1}$			1.42
			(9.10***)
$D_{NonUS}\,FEPS_{t+1}$			1.45
			(1.52)
P_{t-5}	0.90	0.83	0.80
	(68.48***)	(47.68***)	(42.43***)
$D_{NonUS}\,P_{t-5}$	0.05	-0.01	-0.04
	(0.74)	(-0.01)	(-0.36)
D_{Up}	0.91	1.43	1.45
	(3.20***)	(5.20***)	(5.49***)
$D_{NonUS}\,D_{Up}$	2.24	8.55	8.91
	(0.61)	(3.26***)	(3.44***)
D_{Down}	-1.28	-0.65	-0.45
	(-8.19***)	(-3.86***)	(-3.35***)
$D_{NonUS}\,D_{Down}$	-7.80	-2.71	-4.56
	(-2.54**)	(-0.77)	(-1.75)
Sample	*51,689*	*51,689*	*51,689*
Adjusted R^2	*0.90*	*0.91*	*0.92*
Akaike Info Criterion	*11.03*	*10.90*	*10.81*
F-Statistic	*68,410****	*50,220****	*47,030****
Log Likelihood	*-285,172*	*-281,816*	*-279,404*

Denotes significance at the 5% level; and, * Denotes significance at the 1% level.

7.7 Conclusion

This chapter provides further evidence on the complementary nature of fundamental and technical analysis in explaining contemporaneous share price. Initially, we consider models solely fitting either fundamental or technical variables. In regards to the fundamental models, consistent with the extant literature (see, for example, Collins *et al*, 1997) the majority of countries find that contemporaneous share price is positively dependent on book value per share and earnings per share. Furthermore, consistent with Dechow *et al* (1999), the inclusion of forecast earnings per share generally subsumes the information contained in earnings per share.

Examination of the technical model revealed, unsurprisingly, that price is positively dependent on lagged price. Further, results for seven of the nine countries find that shares exhibiting returns in the six month formation period that place them in the top (bottom) performance decile continue to enjoy similar positive (negative) performance in the subsequent six months.

However, the results of testing our hybrid models across all countries reveals the superior explanatory power of these models relative to those considering either fundamental or technical variables in isolation. The strength of our hybrid models is best evidenced by their markedly higher (lower) adjusted R^2 (AIC) values relative to models solely incorporating either fundamental or technical measures, with further verification provided by the highly significant likelihood ratio tests.

Chapter Eight: Conclusion

The extant literature invests considerable effort in assessing the importance of fundamental and technical factors in equity valuation exercises. However, in doing this, the literature invariably focuses on one set of factors without reference to the other. In employing such an approach, the literature neglects the possibility that fundamental and technical factors could serve as complements rather than substitutes in equity valuation exercises. In bridging this gap in the literature, we propose an equity valuation model integrating both fundamental and technical measures.

Prior to considering whether fundamental and technical analyses complement one another in the context of equity valuation exercises, we examine the explanatory power of each type of analysis in isolation. We consider the strength of these models in Australia, the US, and seven other countries, as well as in aggregate. Thereafter, we evaluate the explanatory power of our hybrid models in the aforementioned countries, providing the first study on the complementary nature of fundamental and technical analyses.

Consistent with evidence presented in the extant literature, preliminary testing confirms the positive dependence of contemporaneous share prices on both book value per share and earnings per share (see, for example, Collins *et al*, 1997, Dechow *et al*, 1999). Further, consistent with Dechow *et* al 1999, the inclusion of forecast earnings per share in these fundamental models generally sees earnings per share ceasing to be significant in explaining share prices.

Results of fitting models only incorporating technical factors confirm the importance of lagged price in explaining contemporaneous price. Further, testing generally shows that shares exhibiting returns in the six month formation period that place them in the top (bottom) performance decile continue to enjoy similar positive (negative) performance in the subsequent six months. Such performance persistence is consistent with the findings of the momentum literature (see, for example, Jegadeesh and Titman, 1993 and 2001).

More importantly, fitting our hybrid models which incorporate both fundamental and technical factors to explain equity prices, provide strong evidence that models integrating both types of measure have superior explanatory power relative to models incorporating either type in isolation. More specifically, the augmentation of fundamental valuation models with our suite of technical measures sees marked increases (decreases) in adjusted R^2 values (AIC values) with the significance of our results further highlighted by the significance of likelihood ratio testing. Overall, our study yields considerable evidence regarding the complementary nature of fundamental and technical factors in equity valuation exercises.

Finally, while we focus on the importance of fundamental and technical factors in equity valuation, our findings have implications for the valuation of other financial instruments. Specifically, future research may consider the complementary nature of fundamental and technical analyses in other markets, such as foreign exchange.

References

1. Akaike, H., 1974, 'A New look at the Statistical Model Identification', *IEEE Transaction on Automatic Control*, vol. 19, pp. 716-723.
2. Allen, F., and Karjalainen, R., 1999, 'Using Genetic Algorithms to find Technical Trading Rules', *Journal of Financial Economics*, vol. 51, pp. 245-271.
3. Amir, E., Kirschenheiter, M., and Willard, K., 1997, 'The Valuation of Deferred Taxes", *Contemporary Accounting Research*, vol. 14, pp. 597-622.
4. Amir, E., and Lev, B., 1996, 'Value-Relevance of Non-Financial Information: The Wireless Communications Industry', *Journal of Accounting and Economics*, vol. 22, pp. 3-30.
5. Barth, M., Beaver, W., and Landsman, W., 1996, 'Value-Relevance of Banks' Fair Value Disclosures under SFAS No. 107', *The Accounting Review*, vol. 71, pp. 513-537.
6. Barth, M., Beaver, W., and Wolfson, M., 1990, 'Components of Earnings and the Structure of Bank Share Prices', *Financial Analysts Journal*, vol. 46, pp. 53-60.
7. Beaver, W., Lambert, R., and Morse, D., 1980, 'The Information Content of Security prices', *Journal of Accounting and Economics*, vol. 2, pp. 3-28.
8. Berger, P., Ofek, E., and Swary, I., 1996, 'Investor Valuation of the Abandonment Option', *Journal of Financial Economics*, vol. 42, pp. 257-287.
9. Brock, W., Lakonishok, J., and LeBaron, B., 1992, 'Simple Technical Rules and the Stochastic Properties of Stock Returns', *Journal of Finance*, vol. 47, pp.1731-1764.
10. Burgstahler, D., and Dichev, I., 1997, 'Earnings, Adaptation and Equity Value', *The Accounting Review*, vol. 72, pp.187-215.

11. Carhart, M., 1997, 'On Persistence in Mutual Fund Performance', *Journal of Finance*, vol. 52, pp. 57-82.

12. Chui, A., Titman, S., and Wei, K., 2000, 'Momentum, Legal Systems and Ownership Structure: An Analysis of Asian Stock Markets'. *Working Paper*. Available at SSRN: http://ssrn.com/abstract=265848 or DOI: 10.2139/ssrn.265848.

13. Collins, D., Maydew, E., and Weiss, I., 1997, 'Changes in the Value-Relevance of Earnings and Book Values Over the Past Forty Years', *Journal of Accounting and Economics*, vol. 24, pp. 39-68.

14. Dechow, P., Hutton, A., and Sloan, R., 1999, 'An Empirical Assessment of the Residual Income Model', *Journal of Accounting and Economics*, vol. 26, pp.1-34.

15. Demir, I., Muthuswamy, J., and Walter, T., 2004, 'Momentum Returns in Australian Equities: The Influences of Size, Risk, Liquidity and Return Computation', *Pacific-Basin Finance Journal*, vol. 12, pp.143-158.

16. Easton, P., 1985, 'Accounting Earnings and Security Valuation: Empirical Evidence of the Fundamental Links', *Journal of Accounting Research*, vol. 23, pp. 54-77.

17. Ely, K., and Waymire, G., 1999, 'Accounting Standard-Setting Organizations and Earnings Relevance: Longitudinal Evidence from NYSE Common Stocks, 1927-93', *Journal of Accounting Research*, vol. 37, pp. 293-317.

18. Fama, E., 1970, 'Efficient Capital Markets: A Review of Theory and Empirical Work,' *Journal of Finance*, vol. 25, pp. 383-417.

19. Fama, E., and French, K., 1993, 'Common Risk Factors in the Returns on Stocks and Bonds', *Journal of Financial Economics*, vol. 33, pp. 3-56.

20. Felsenstein, J., 1981, 'Evolutionary trees from DNA sequences: A Maximum Likelihood Approach,' *Journal of Molecular Evolution*, vol. 17, pp. 368-376.

21. Ferson, W., Sarkissian, S., and Simin, T., 2003a, 'Spurious Regressions in Financial Economics?', *Journal of Finance*, vol. 58, pp.1393-1413.

22. Ferson, W., Sarkissian, S., and Simin, T., 2003b, 'Is Stock Return Predictability Spurious?', *Journal of Investment Management*, vol. 1, pp.1-10.

23. Forner, C., and Marhuenda, J., 2003, 'Contrarian and Momentum Strategies in the Spanish Stock Market', *European Financial Management*, vol. 9, pp. 67-88.

24. Gordon, M., and Shapiro, E., 1956, 'Capital Equipment Analysis: The Required Rate of Profit', *Management Science*, vol. 3, pp. 102-110.

25. Graham, B., and Dodd, D., 1996, 'Security Analysis: The Classic 1934 Edition', McGraw-Hill, New York.

26. Granger, C., Hyung, N., and Jeon, Y., 2001, 'Spurious Regressions with Stationary Series', *Applied Economics*, vol. 33, pp. 899-904.

27. Griffin, J., Ji, X., and Martin, J., 2003, 'Momentum Investing and Business Cycle Risk: Evidence from Pole to Pole', *Journal of Finance*, vol. 58, pp. 2515-2547.

28. Grundy, B., and Martin, J., 2001. 'Understanding the Nature of the Risks and the Source of the Rewards to Momentum Investing', *The Review of Financial Studies*, vol.14, pp. 29-78.

29. Hameed, A., and Kusnadi, Y., 2002, 'Momentum Strategies: Evidence from Pacific Basin Stock Markets,' *The Journal of Financial Research*, vol. 25, pp. 383-397.

30. Holthausen, R., and Watts, R., 2001, 'The Relevance of the Value-Relevance Literature for Financial Accounting Standard Setting,' *Journal of Accounting and Economics*, vol. 31, pp. 3-75.

31. Huelsenbeck, J., and Crandall, K., 1997, 'Phylogeny Estimation and Hypothesis Testing using Maximum Likelihood,' *Annual Review of Ecology and Systematics*, vol. 28, pp. 437-466.

32. Huelsenbeck, J., and Rannala, B., 1997, 'Phlyogenetic Methods Come of Age: Testing Hypotheses in an Evolutionary Context,' *Science*, vol. 276, pp. 227-232.

33. Hurn, S., and Pavlov, V., 2003, 'Momentum in Australian Stock Returns,' *Australian Journal of Management*, vol. 28, pp. 141-155.

34. Jegadeesh, N., and Titman, S., 1993, 'Returns to Buying Winners and Selling Losers', *Journal of Finance*, vol. 48, pp. 65-91.

35. Jegadeesh, N., and Titman, S., 2001, 'Profitability of Momentum Strategies: An Evaluation of Alternative Explanations,' *Journal of Finance*, vol. 56, pp. 699-720.

36. Jensen, M., and Bennington, G., 1970, 'Random Walks and Technical Theories: Some Additional Evidence,' *Journal of Finance*, vol. 25, pp. 469-482.

37. Joos, P., and Lang, M., 1994, 'The Effects of Accounting Diversity: Evidence from the European Union,' *Journal of Accounting Research*, vol. 32 Supplement, pp. 141-168.

38. Ota, K., 2002, 'A Test of the Ohlson (1995) Model: Empirical Evidence from Japan,' *The International Journal of Accounting*, vol. 37, pp. 157-182.

39. Korajczyk, R., and Sadka, R., 2004, 'Are Momentum Profits Robust to Trading Costs?,' *Journal of Finance*, vol. 59, pp. 1039-1082.

40. Liu, W., Strong, N., and Xu, X., 1999, 'The Profitability of Momentum Investing,' *Journal of Business Finance and Accounting*, vol. 26, pp.1043-1091.

41. Lo, A., and MacKinlay, C., 1988, 'Stock Market Prices do not follow Random Walks: Evidence from a Simple Specification Test,' *Review of Financial Studies*, vol. 1, pp. 41-66.

42. Lo, A., and MacKinlay, C., 1999, 'A Non-Random Walk Down Wall Street', Princeton University Press, Princeton, N.J.

43. Marshall, B., and Cahan, R., 2005, 'Is the 52-week high momentum strategy profitable outside the US?,' *Applied Financial Economics*, vol. 15, pp. 1259-1267.

44. Morel, M., 2003, 'Endogenous Parameter Time Series Estimation of the Ohlson Model: Linear and Nonlinear Analyses,' *Journal of Business Finance and Accounting*, vol. 30, pp.1341-1362.

45. Newey, W., and West, K., 1987, 'A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix,' *Econometrica*, vol. 55, pp. 703-708.

46. Nijman, T., Swinkels, L., and Verbeek, M., 2002, 'Do Countries or Industries Explain Momentum in Europe?,' ERIM Report Series Reference No. ERS-2002-91-F&A Available at SSRN: http://ssrn.com/abstract=301533 or DOI: 10.2139/ssrn.301533

47. Ohlson, J., 1995, 'Earnings, Book Values and Dividends in Security Valuation,' *Contemporary Accounting Research*, vol. 11, pp. 661-687.

48. Ready, M., 2002, 'Profits from Technical Trading Rules,' *Financial Management*, vol. 31, pp. 43-61.

49. Rouwenhorst, K., 1998, 'International Momentum Strategies,' *Journal of Finance*, vol. 53, pp. 267-284.

50. Rouwenhorst, K., 1999, 'Local Return Factors and Turnover in Emerging Stock Markets,' *The Journal of Finance*, vol. 54, pp. 1439-1464.

51. Sullivan, R., Timmermann, A., and White, H., 1999, 'Data-Snooping, Technical Trading Rule Performance, and the Bootstrap,' *Journal of Finance*, vol. 54, pp. 1647-1691.

52. Taylor, M., and Allen, H., 1992, 'The use of Technical Analysis in the Foreign Exchange Market,' *Journal of International Money and Finance*, vol. 11, pp.304-314.

53. Yule, G., 1926, 'Why do we sometimes get Nonsense Correlations between Time Series? A Study in Sampling and the Nature of Time Series', *Journal of the Royal Statistical Society*, vol. 89, pp.1-64.

Appendix A: Country Descriptive Statistics

Table A.1: Australia Descriptive Statistics

Table A.1 presents the descriptive statistics in Australian dollars for the sample utilised in testing (n = 1,772). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	4.4274	4.9240	0.0680	38.1200	1.4485	2.9400	5.2018
P_{t-5}	4.4716	5.4916	0.0600	49.5640	1.4538	2.8500	5.0948
$BVPS_t$	2.1537	1.9268	0.0090	14.9920	0.8290	1.6085	2.8345
EPS_t	0.1726	0.6037	-4.7870	2.9100	0.0728	0.1660	0.3133
$FEPS_{t+1}$	0.2773	0.3128	-1.9470	1.9670	0.1080	0.2055	0.3540

Table A.2: Canada Descriptive Statistics

Table A.2 presents the descriptive statistics in Canadian dollars for the sample utilised in testing (n = 1,252). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	23.74	51.95	0.19	585.00	7.15	13.50	22.52
P_{t-5}	22.34	49.11	0.11	574.00	6.41	12.50	20.05
$BVPS_t$	13.69	31.83	0.06	259.33	3.47	7.01	11.91
EPS_t	0.34	8.16	-14.20	32.63	0.22	0.68	1.36
$FEPS_{t+1}$	1.16	1.56	-1.41	23.96	0.35	0.86	1.50

Table A.3: France Descriptive Statistics

Table A.3 presents the descriptive statistics in Euros for the sample utilised in testing (n = 1,564). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	36.37	31.22	0.25	367.50	14.45	28.64	49.50
P_{t-5}	36.21	35.96	0.26	369.20	14.76	27.86	48.46
$BVPS_t$	21.44	22.68	0.02	316.05	6.53	14.76	28.75
EPS_t	1.41	4.13	-52.80	37.34	0.23	1.34	2.85
$FEPS_{t+1}$	2.40	2.81	-6.66	55.49	0.79	1.88	3.33

Table A.4: Germany Descriptive Statistics

Table A.4 presents the descriptive statistics in Euros for the sample utilised in testing (n = 941). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	62.45	68.57	0.62	693.50	14.18	28.21	60.80
P_{t-5}	60.77	69.94	0.61	780.05	13.78	25.68	57.34
$BVPS_t$	24.85	36.03	0.01	157.97	7.13	13.11	27.55
EPS_t	2.16	7.15	-52.38	114.34	0.38	1.29	2.59
$FEPS_{t+1}$	2.78	4.66	-12.95	42.21	0.82	1.65	3.02

Table A.5: Hong Kong Descriptive Statistics

Table A.5 presents the descriptive statistics in Hong Kong dollars for the sample utilised in testing (n = 1,672). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	9.22	15.27	0.02	114.00	1.22	3.10	9.75
P_{t-5}	8.83	14.76	0.03	117.00	1.20	3.14	9.15
$BVPS_t$	6.97	13.31	0.01	102.03	1.06	2.48	8.19
EPS_t	0.73	1.88	-7.54	49.84	0.12	0.27	0.78
$FEPS_{t+1}$	0.79	1.11	-0.62	7.55	0.17	0.34	0.92

Table A.6: Japan Descriptive Statistics

Table A.6 presents the descriptive statistics in Japanese Yen for the sample utilised in testing (n = 7,379). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	3,627.36	2,901.50	14.70	10,900.54	505.00	885.00	1,700.00
P_{t-5}	3,303.69	3,592.72	20.25	23,500.68	405.00	747.00	1,450.00
$BVPS_t$	1,416.99	846.09	2.44	21,919.81	326.24	578.57	1,034.74
EPS_t	35.32	260.94	-174.57	14,121.14	7.09	23.68	58.67
$FEPS_{t+1}$	112.09	611.24	-51.70	9,726.60	13.20	31.10	70.30

Table A.7: Singapore Descriptive Statistics

Table A.7 presents the descriptive statistics in Singaporean dollars for the sample utilised in testing (n = 926). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	2.19	3.35	0.05	40.00	0.50	1.03	2.33
P_{t-5}	2.06	3.01	0.10	37.22	0.47	0.98	2.19
$BVPS_t$	1.55	1.82	0.02	12.32	0.31	0.84	2.21
EPS_t	0.10	0.24	-0.77	3.35	0.02	0.05	0.14
$FEPS_{t+1}$	0.18	0.76	-0.25	18.00	0.04	0.07	0.17

Table A.8: United Kingdom Descriptive Statistics

Table A.8 presents the descriptive statistics in UK pounds for the sample utilised in testing (n = 3,155). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	309.99	307.78	4.42	3,650.00	122.41	232.50	404.55
P_{t-5}	293.72	296.30	4.67	3,657.50	115.00	216.00	380.00
$BVPS_t$	135.70	137.48	0.38	1107.81	43.34	93.69	176.88
EPS_t	14.80	29.96	-230.49	302.40	4.60	12.70	24.09
$FEPS_{t+1}$	20.35	20.90	-106.89	243.56	7.62	15.27	27.69

Table A.9: United States Descriptive Statistics

Table A.9 presents the descriptive statistics in US dollars for the sample utilised in testing (n = 33,952). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*	*25th Percentile*	*Median*	*75th Percentile*
P_{t+1}	15.67	13.55	0.07	154.50	7.13	13.25	22.25
P_{t-5}	16.24	13.04	0.09	132.00	7.13	13.00	21.50
$BVPS_t$	8.12	7.27	0.01	21.31	3.27	6.21	10.83
EPS_t	0.64	1.68	-23.59	23.54	0.15	0.61	1.23
$FEPS_{t+1}$	1.02	1.16	-9.63	35.00	0.39	0.85	1.50

Appendix B: Country Correlation Matrices

Table B.1: Australia Correlation Matrices

Table B.1 presents the correlation matrices in Australian dollars for the sample utilised in testing (n = 1,772). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+1}$
P_{t+1}	1.00				
P_{t-5}	0.87	1.00			
$BVPS_t$	0.73	0.66	1.00		
EPS_t	0.40	0.33	0.34	1.00	
$FEPS_{t+1}$	0.70	0.62	0.66	0.41	1.00

Table B.2: Canada Correlation Matrices

Table B.2 presents the correlation matrices in Canadian dollars for the sample utilised in testing (n = 1,252). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+1}$
P_{t+1}	1.00				
P_{t-5}	0.76	1.00			
$BVPS_t$	0.74	0.69	1.00		
EPS_t	0.30	0.28	0.13	1.00	
$FEPS_{t+1}$	0.23	0.25	0.47	0.18	1.00

Table B.3: France Correlation Matrices

Table B.3 presents the correlation matrices in Euros for the sample utilised in testing (n = 1,564). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+1}$
P_{t+1}	1.00				
P_{t-5}	0.74	1.00			
$BVPS_t$	0.69	0.67	1.00		
EPS_t	0.46	0.37	0.36	1.00	
$FEPS_{t+1}$	0.74	0.66	0.67	0.62	1.00

Table B.4: Germany Correlation Matrices

Table B.4 presents the correlation matrices in Euros for the sample utilised in testing (n = 941). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+1}$
P_{t+1}	1.00				
P_{t-5}	0.84	1.00			
$BVPS_t$	0.67	0.59	1.00		
EPS_t	0.56	0.53	0.62	1.00	
$FEPS_{t+1}$	0.76	0.63	0.67	0.56	1.00

Table B.5: Hong Kong Correlation Matrices

Table B.5 presents the correlation matrices in Hong Kong dollars for the sample utilised in testing (n = 1,672). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+1}$
P_{t+1}	1.00				
P_{t-5}	0.77	1.00			
$BVPS_t$	0.76	0.77	1.00		
EPS_t	0.62	0.61	0.69	1.00	
$FEPS_{t+1}$	0.59	0.68	0.58	0.59	1.00

Table B.6: Japan Correlation Matrices

Table B.6 presents the correlation matrices in Japanese Yen for the sample utilised in testing (n = 7,379). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share rice in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+1}$
P_{t+1}	1.00				
P_{t-5}	0.78	1.00			
$BVPS_t$	0.71	0.58	1.00		
EPS_t	0.11	0.06	0.05	1.00	
$FEPS_{t+1}$	0.79	0.64	0.74	0.04	1.00

Table B.7: Singapore Correlation Matrices

Table B.7 presents the correlation matrices in Singaporean dollars for the sample utilised in testing (n = 926). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+1}$
P_{t+1}	1.00				
P_{t-5}	0.74	1.00			
$BVPS_t$	0.68	0.71	1.00		
EPS_t	0.66	0.64	0.55	1.00	
$FEPS_{t+1}$	0.25	0.25	0.16	0.19	1.00

Table B.8: United Kingdom Correlation Matrices

Table B.8 presents the correlation matrices in UK pounds for the sample utilised in testing (n = 3,155). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+1}$
P_{t+1}	1.00				
P_{t-5}	0.75	1.00			
$BVPS_t$	0.54	0.54	1.00		
EPS_t	0.50	0.48	0.40	1.00	
$FEPS_{t+1}$	0.74	0.72	0.58	0.66	1.00

Table B.9: United States Correlation Matrices

Table B.9 presents the correlation matrices in US dollars for the sample utilised in testing (n = 33,952). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+1}$
P_{t+1}	1.00				
P_{t-5}	0.87	1.00			
$BVPS_t$	0.56	0.59	1.00		
EPS_t	0.38	0.36	0.38	1.00	
$FEPS_{t+1}$	0.62	0.61	0.66	0.60	1.00